



MWD Logging System

User Manual

Table of Contents

Overview	3
Installation	4
Ubuntu Linux 18.04 and above	4
Windows Subsystem for Linux (WSL) Version	4
Equipment Configuration	5
Software Configuration	7
Starting a new job	8
Well Information Tab	9
Email/Login Tab	10
Surveys Tab	11
Superior QC	12
WITS ID's Tab	15
Decoder Tab	19
WITSML Tab	20
Mail/Logo Tab	22
Ports Tab	24
Monitoring Section	25
Dashboard Tab	25
Well Plots Tab	28
Rig WITS Tab	28
Decoder and Aux Port Tabs	28
Depth/Sim Tab	28
Data Management Section	31
Survey Data Tab	31
Log Data Tab	32
Importing Time-based CSV Files	33
Plotting Tab	36
Custom Headers	38
Generate LAS Tab	50
Other Applications	51
Firefox Configuration	51
Adobe Acrobat PDF Reader Configuration	52
Plot a PDF Log on a Printex Plotter using Adobe's Acrobat	53
FoxIt PDF Reader	54
Troubleshooting	54

Overview

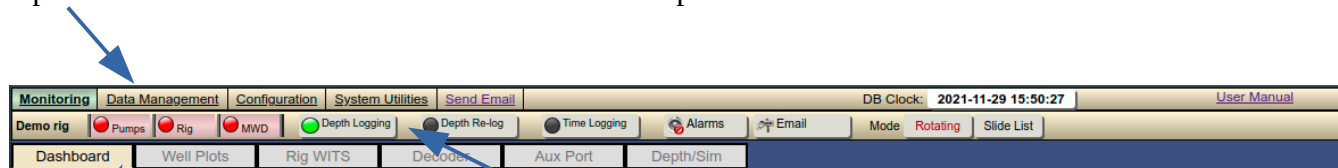
The Polaris Logging System is complete solution for the MWD professional. This manual will assume that the audience has a basic understanding of the processes that are required in performing the job of MWD personnel. It will also be assumed that the audience has the computer hardware skills such as COM ports, null-modem cables and, when providing depth tracking, the knowledge of how a drilling rig operates for installing sensors.

The system is divided into two main components:

- The data handling processes and report generation applications
 - Importing and exporting data in standard formats
 - Generating survey reports and MWD data plots
 - Handling COM port communications with the Drilling Rig and downhole data decoder
 - Generating automated Email messages for and managing of contacts involved in the project
 - Archiving data to WITSML servers
 - Updating the Polaris Dashboard servers
- WEB-based user interface
 A standard WEB browser is used to operate the system. Compatible browsers include Microsoft Edge, Firefox, Google Chrome, Chromium and Opera. Compatibility with Apple's Safari is unknown and Internet Explorer is NOT supported

All of the data handling processes run in the background while a graphical WEB based user interface is used to control these processes and applications.

Operations are divided into 4 main sections at the top bar



On the monitoring page the middle bar supplies diagnostics and control buttons

Multiple tabs are available for each main section



USER MANUAL

Installation

The Polaris Logging System can be installed natively on a Ubuntu Linux laptop or it can be installed on Microsoft Windows using their WSL technology.

Ubuntu Linux 18.04 and above

The Polaris Guidance System's Logging System software was written specifically to run on the Ubuntu Linux Operating System. This document will guide you through installing the Polaris Logging System on a computer that has Ubuntu Linux already installed and operating.

Installing the Polaris software on a computer of its own has its advantages and the steps are simple:

- Install Ubuntu 18.04 (or greater) Linux on your computer
- During installation it is important that the default user login is “polaris” and set the password to “polaris”
- Login as “**polaris**” and download the installation program from the Dropbox link sent to you by a Polaris representative. (Contact Polaris sales for further information)
- Right-click the downloaded .zip file and select “**Extract Here**”
- Open the extracted folder and double-click on the “**install_polaris**” icon
- Reboot and login as “**polaris**”. Double-click the “**Polaris Logging System**” icon on the Desktop to get started

The user manual for the Polaris software can be viewed by clicking the “**User Manual**” at the top-right for the user interface.

Windows Subsystem for Linux (WSL) Version

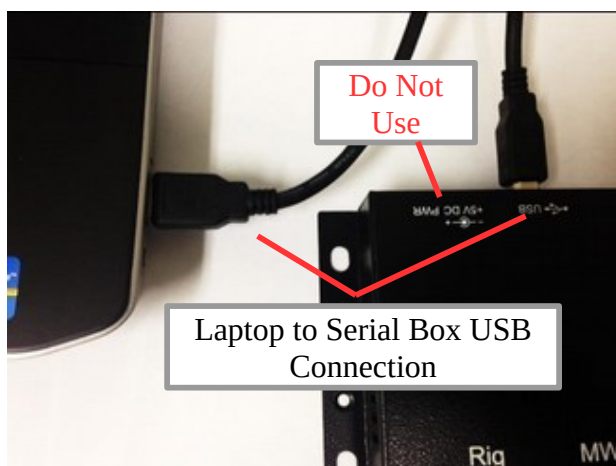
Microsoft's Windows operating system has the ability to execute Linux applications utilizing their WSL virtual environment. Since the Polaris Logging System was written for the Linux operating system this technology allows all of the applications to operate in the background under Windows.

The installation process is quite a bit different and is prone to change periodically as Microsoft updates its operation system. For this reason the installation instructions will be included in the downloaded package you receive from a Polaris representative.

Equipment Configuration

The only equipment required are USB to serial port adapters so that the system can communicate with the Rig monitoring equipment and the surface decoder of the MWD tool. When connecting two computers together using serial ports a null-modem cable is required.

In some cases Polaris may supply a USB to 4 port serial adapter that is labeled for each connection. Connect Serial Box to Polaris computer with the supplied USB Cable.



***** Warning***** The USB Cable provides power to the Serial Box. **DO NOT** plug any power cable into the power port on the Serial Box, as this may cause an oversupply of voltage that will damage the Serial Box

Your company may provide alternative solutions such as a single USB to serial port adapters for each input. Refer to your company reference for information pertaining to their equipment.



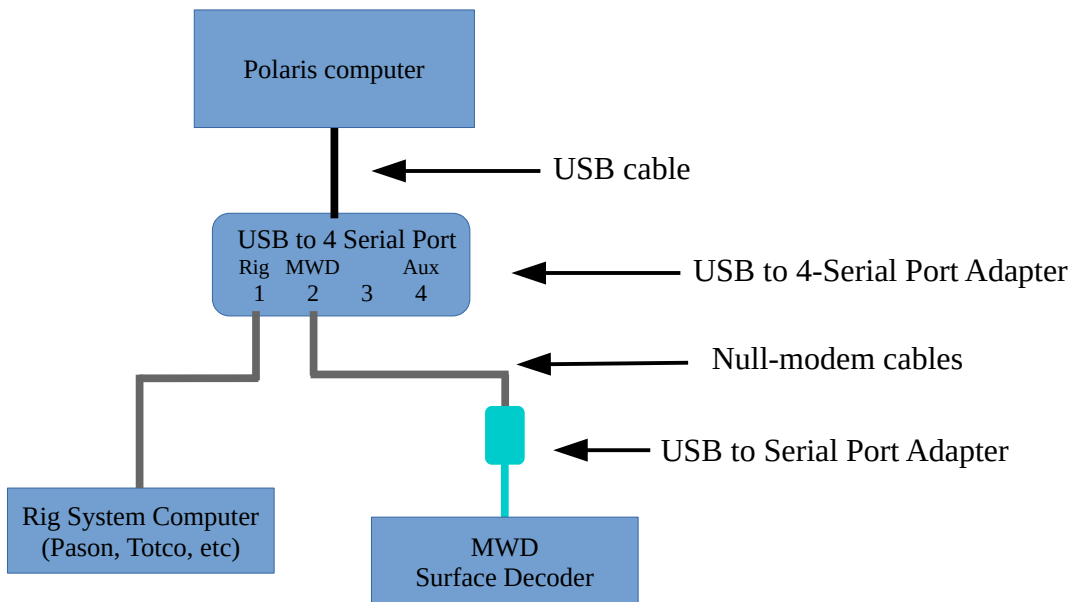
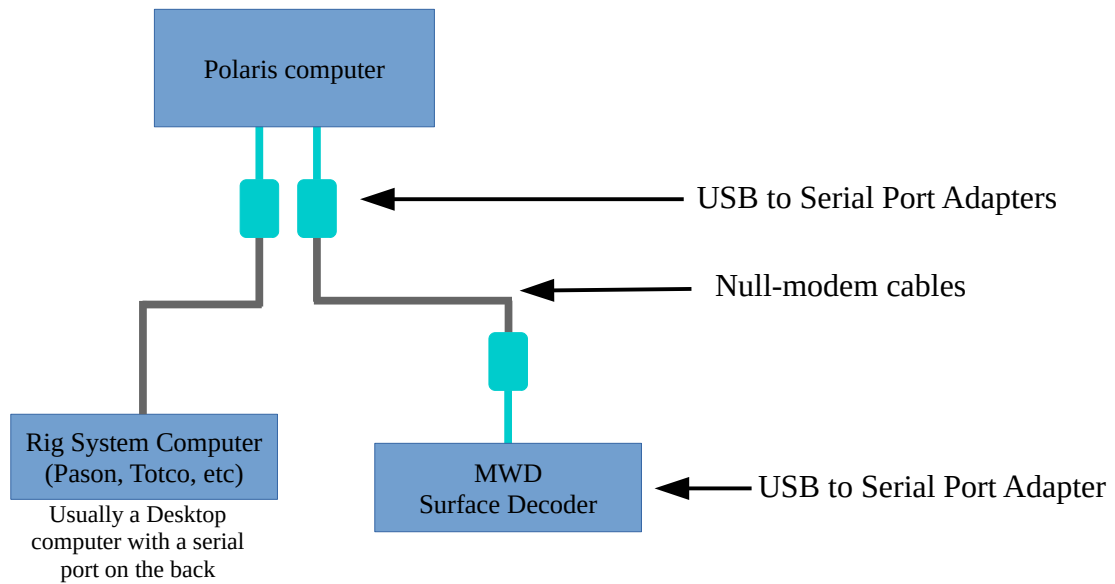
USB to 4 serial port adapter



USB to single serial port adapter

For more information about configuring and testing serial ports see the [Ports Tab section](#)

A couple of basic diagrams of how the system connects via serial ports:



Software Configuration

Linux laptop:

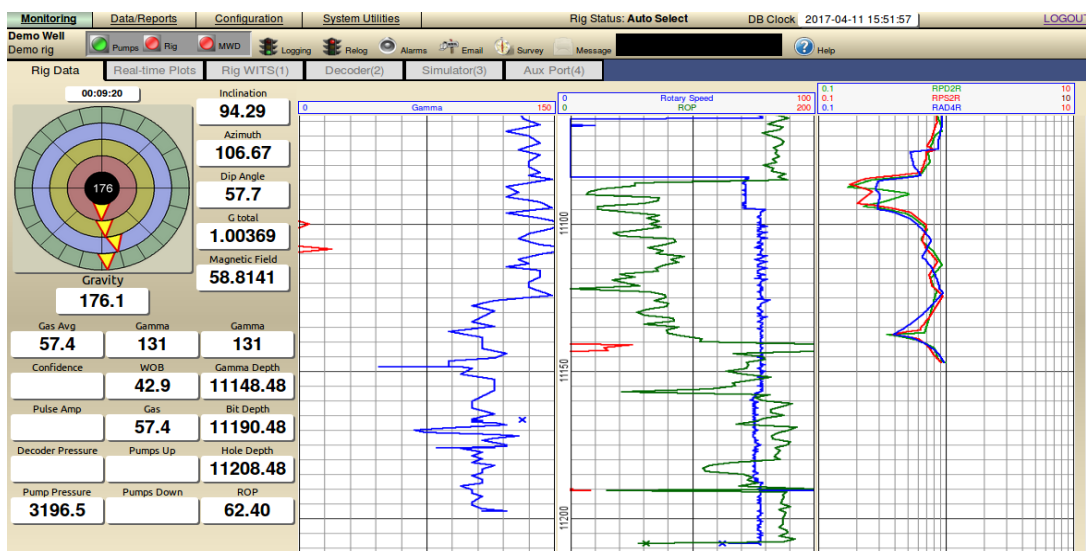
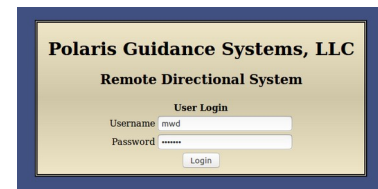
- Open the Firefox WEB Browser and enter “**localhost**” in the address bar.
- Since you are logging in from the Polaris laptop the software will not ask for a user name and password

Windows WSL:

- Open the Polaris WEB Client application
- After initialization and system checking the application will automatically attach to the running Polaris Logging System

NOTE: If you are logging in from a remote computer then you will require a User name and Password to access the system.

- If you are on the same subnet then the user name is “**mwd**” and password is “**polaris**”
- If you logging in from outside the local subnet then you will have to use the user name and password configured at location. These remote users and their passwords are managed in the software **configuration** section later in this manual
- Windows WSL version does not allow outside access

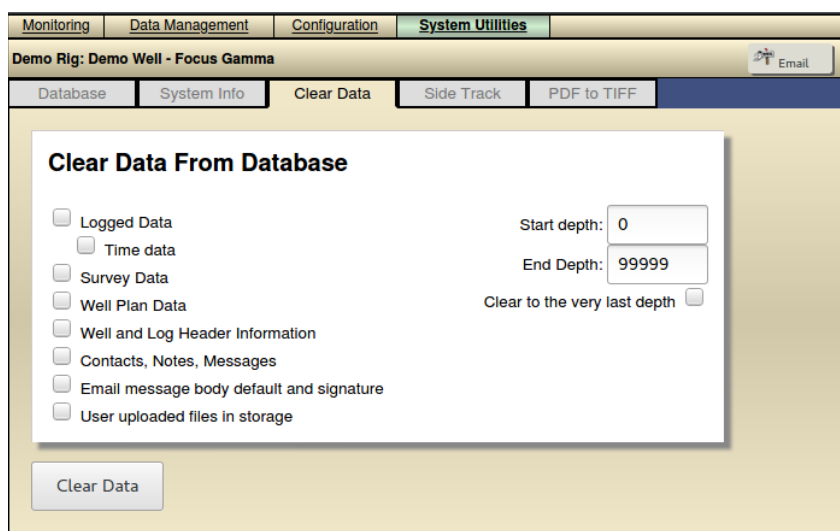


Main screen is used for real-time monitoring

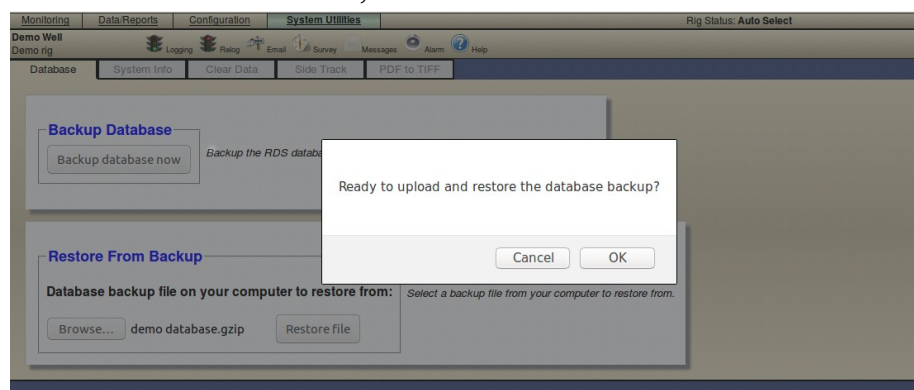
Starting a new job

There are two ways to start a new job: (1) **Start a new job by clearing the current database**, or (2) **Loading a completely new database**:

- **Starting a new job by clearing the current database**
 - Click on the “**System Utilities**” link and go to the “**Clear Data**” tab
 - Click on all check boxes to clear that data from the system. Caution: once the data is cleared is cannot be restored so please ensure you have a backup
 - Leave Start Depth and End Depth as default (0-99999). This will cover all logged data

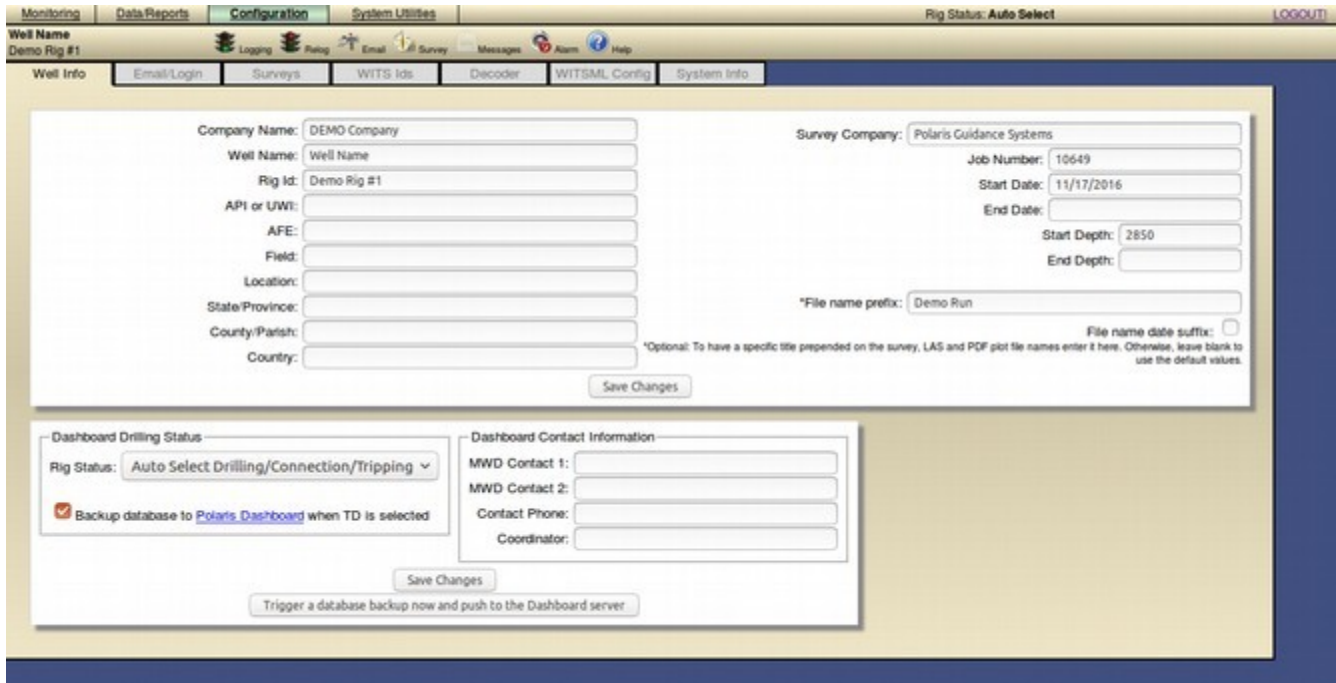


- **Restoring a Database:**
 - Click on “**Database**” tab, then click “**Browse**” under “**Restore from Backup**”
 - Once the file is selected, click “**Restore File**”



Well Information Tab

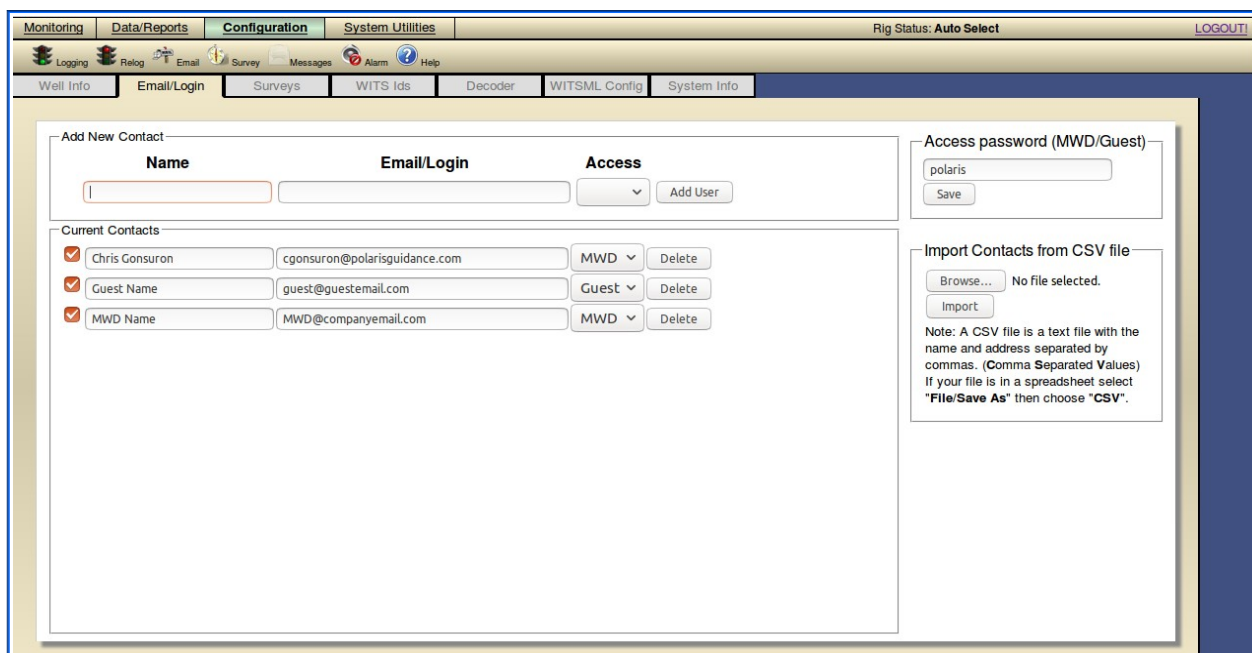
Click on the “Configuration” link at the top to set up all the parameters for the job. Here you will enter in all the necessary Well/Job/On Site contact information as well as the current Drilling Status



- **File name prefix:** (optional) If desired, enter the text that is to precede each file’s name
- **File name date suffix:** (optional) Checking this option will append the current date to each file’s name
- **Dashboard Drilling Status:** (optional) The Polaris Dashboard Monitoring Service provides centralized monitoring of systems in the field. If your company is using the Polaris Dashboard Service then this area will provide additional information and functionality.
 - **Rig Status:** Select the appropriate status for the current rig operations. (*As the status changes this selection will need to be updated*)
 - **Backup database to Polaris Dashboard when TD is selected:** Check this option in order to have the Dashboard keep a copy of your database permanently for future access. The permanent backup will occur once you select “TD” in the Rig Status selection
 - **Dashboard Contact Information:** General information that is transmitted to the Dashboard for reference

Email/Login Tab

The **Email/Login** tab is used to manage the contacts list for Emailing reports in bulk. To add contacts simply provide a name and Email address for each contact that is to receive Email. Un-checking the checkbox on the left of each contact will disable that contact from receiving Email. Changing the “**Access**” permission to either “**MWD**” or “**Guest**” will allow this contact to login to the system remotely. That contact’s user name will be the Email address and the password will be the **Access password** you provide (see below)



The screenshot displays the 'Email/Login' configuration window. At the top, there's a navigation bar with tabs: Monitoring, Data/Reports, Configuration (active), and System Utilities. Below this is a sub-bar with icons for Logging, Relog, Email, Survey, Messages, Alarm, and Help. The main area is divided into several sections:

- Add New Contact:** A form with fields for Name, Email/Login, and Access (a dropdown menu). There is an 'Add User' button.
- Current Contacts:** A table listing existing contacts with checkboxes, names, email addresses, access levels, and delete buttons.

	Name	Email/Login	Access	Action
☒	Chris Gonsuron	cgonsuron@polarisguidance.com	MWD	Delete
☒	Guest Name	guest@guestemail.com	Guest	Delete
☒	MWD Name	MWD@companyemail.com	MWD	Delete
- Access password (MWD/Guest):** A section with a text input field containing 'polaris' and a 'Save' button.
- Import Contacts from CSV file:** A section with a 'Browse...' button, a status 'No file selected.', and an 'Import' button. Below this is a note explaining the CSV format.

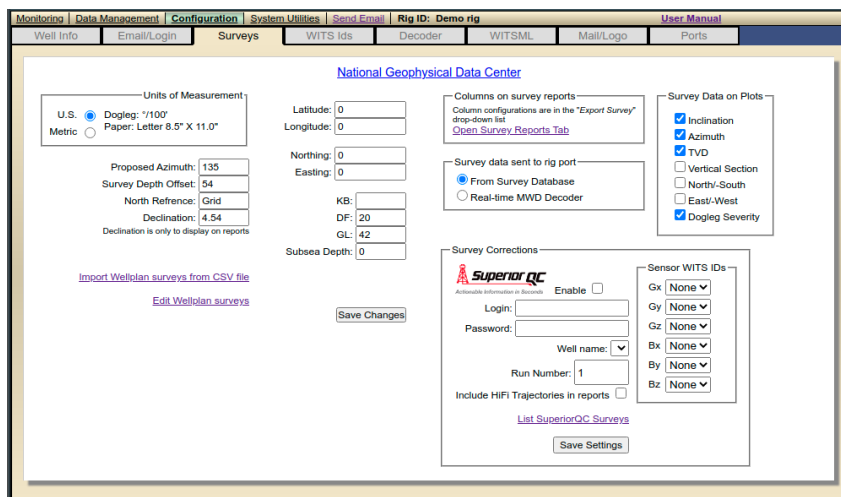
Optionally, contacts can be imported from a CSV text file. The CSV file should contain two columns: Name, Email. The two columns can be in any order.

Access Password: The password is used for remote logins (if enabled) from each contact/user.

Access Groups: The three different Access Groups Options are:

- **MWD:** Full control over the RDS. Can create logs, assist in editing, or help make any changes necessary. The on-site field hand will have this level of access as well as anyone running the job from the command center.
- **Guest:** Any contact with this access will have limited access. They can view the Rosebud or print any logs that they may need at any time, but cannot make any changes to any of the settings. This should be given to the Company Man, Geologist, etc.
- **None:** If access is left “blank”, then the user will not be able to login to the system.

Surveys Tab



The screenshot shows the 'Surveys' tab in the software. It includes sections for 'Units of Measurement' (U.S. and Metric), 'Survey Data' (Latitude, Longitude, Northing, Easting, KB, DF, GL, Subsea Depth), 'Survey Corrections' (Superior QC), and 'Sensor WITS IDs' (Gx, Gy, Gz, Bx, By, Bz). There are also links for 'National Geophysical Data Center', 'Import Wellplan surveys from CSV file', and 'Edit Wellplan surveys'.

- **Units of Measurement:** Switch between U.S. and metric units of measurement. This affects survey dog-leg (degrees per 100 ft to degrees per 30 meters), MWD log plot scale selections/labeling and paper size.
- **Proposed Azimuth:** For directional calculations. This must be entered correctly in order to calculate the correct closure

- **Survey Depth Offset:** Offset Distance from the bit to the tool's directional sensors
- **North Reference, Declination, Lat/Long:** Only used for Survey Log Header Information display (not used in calculations)
- **Northing/Easting:** If entered, the calculations for northing/easting are performed
- **KB/DF/GL:** Information used for each plot header
- **Subsea Depth:** Offset used when plotting TVDs
- **Survey Data on Plots:** Selects which survey data to print in the columns of a plot
- **Survey Data sent to Rig Port:** Survey data transmitted to the Rig WITS system can either be taken from the survey database or in real-time from the MWD Decoder

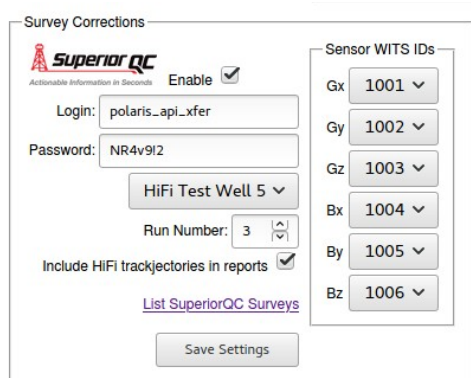
Well Plan Surveys

Well planning surveys can be imported in order to plot along side of the actual surveys. To import well planning surveys from a CSV text file ensure that the first line of the file contains full tie-in data and the remainder are simply depth/inclination/azimuth lines

The first line should be in the following order: depth, inc, azm, tvd, vs, ns, ew
The remainder of the lines should contain at least: depth, inc, azm

Superior QC

When enabled the SuperiorQC option allows the Polaris system to directly send 6-axis survey data to the SuperiorQC WEB site.



In the Configuration section under Survey enter your login and password then select the appropriate well and run number.

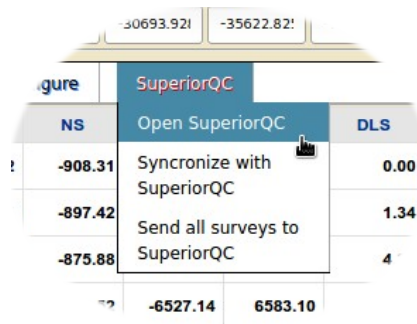
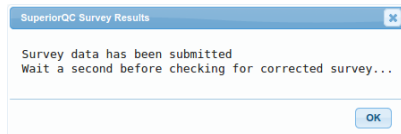
It is very important that you select the correct well and run number before proceeding!

Choose all 6-axis WITS IDs (must have all 6)

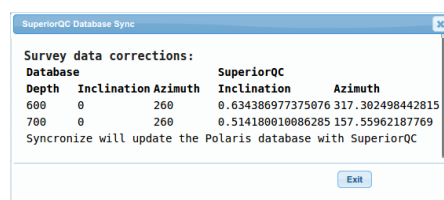
Once enabled the Superior QC menu will appear in the Polaris survey editor

Store survey data as normal

Once all the survey data is collected simply click the “**Store Survey**” button as normal.



The 6-axis sensor values are transmitted to the Superior QC server for processing. After allowing some time for the Superior QC server to process the data use the “**Synchronize with SuperiorQC**” function in the menu to get and apply survey corrections to the Polaris database.



Synchronize Superior QC Results

When enabled the Superior QC servers will be in control of determining the disposition of the survey data. Polaris has added two columns to facilitate synchronization: “**Xclude**” and “**TYPE**”

The **Xclude** check will prevent a survey from being processed by Polaris or Superior QC

Surveys		Export Surveys		Plot Surveys		Configure	Sup.	
#	Xclude	Del	Depth ↑	Inc	Azm	TVD	TYPE	RUN
	☐	☒	5104.00	6.21	34.52	5084.66	CORRECTED	2 0.9%
38	☐	☒	5199.00	5.44	41.21	5179.16	CORRECTED	2 0.994%
39	☐	☒	5293.00	6.36	36.90	5272.68	CORRECTED	2 0.9921%
—	☒	☒	5388.00	6.48	36.36		REJECTED	2 0.9921%
40	☐	☒	5483.00	6.05	37.54	5461.55	CORRECTED	2 0.9931%
41	☐	☒	5672.00	5.95	46.12	5649.56	CORRECTED	2 0.9931%
	☐	☒	5766.00	5.67	44.02	5743.07	CORRECTED	2 0.9931%
	☐	☒	5861.00	5.37	42.80	5837.63	CORRECTED	2 0
	☐	☒	5956.00	5.64	48.93	5932.20	CORRECTED	2
	☐	☒	6050.00	5.50	49.08	6025.76	CORRECTED	

The “**TYPE**” column serves 3 purposes:

1. Set to “**IMPORTED**” by the user to prevent sending a survey to the Superior QC server for processing
2. If set to “**STANDARD**” the survey will be processed by the Superior QC server.
3. Upon synchronization the Superior QC server

will update this value to either “**CORRECTED**” or “**REJECTED**” depending on the outcome of processing.

Note that if the Superior QC server rejects a survey it will also set the Xclude checkbox automatically.

Synchronize often

The Superior QC servers are continuously re-evaluating all surveys that it has in storage and will periodically make further adjustments depending on historical performance. Because of this it is highly recommended to synchronize as often as possible in order to keep the Polaris surveys up-to-date. Polaris will automatically perform a synchronization when first opening the survey editor but it is up to the user to perform synchronizations while the survey editor remains open.

Bit Projections

Bit projections (PTB) are performed by the Superior QC servers and are automatically stored on the Polaris database when generated by the Superior QC server. If the PTB does not show up wait a few seconds and try to synchronize again.

If the PTB still fails to appear then consult with the Superior QC RTOC

Superior QC HiFi Navigation

When using HiFi Navigation the extra computer generated trajectory points will be included in the Polaris survey reports.

Send all surveys to Superior QC

Use this menu function to transmit all valid surveys to the Superior QC server. Surveys that are marked as “Xclude” or has a survey type of “IMPORTED” will not be transmitted.

Edit SuperiorQC server data directly

Typically the Polaris software will take care of making changes to depth and survey type using it’s own editor but a grid editor is also available to change the following parameters on the Superior QC server directly if needed:

- Type (left column): Choose one of “STANDARD”, “REJECTED” or “IMPORTED”
- MD (left column): (measured depth) can also be changed in case of an error on initial entry



Well: HiFi Test Well 5
Run: 3

Rows per page
20

Include Sensors: ☐

Include HiFi Trajectory Points: ☐

Close

Actionable Information in Seconds

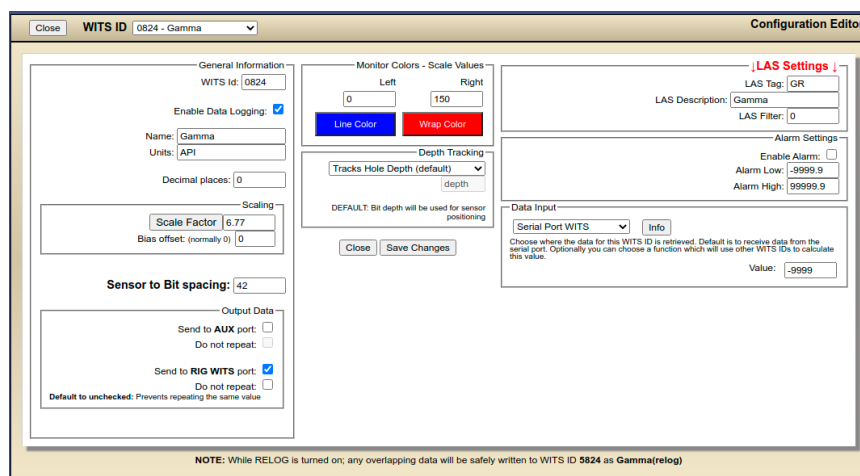
1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

Run	Tracking ID	Last Changed	Type	MD	INC	AZM	Corrected	MD(c) ↓	INC(c)	AZM(c)	TVD	Northing	Easting
3				-	-	-	Projection to Bit	12122.00	90.49	257.88	5467.02	-908.31	-6774.06
3	1605030884	2020-11-10 11:54:44	STANDARD	12070.00	90.00	260.00	CORRECTED	12070.00	90.20	257.88	5467.35	-897.42	-6723.22
3	1605030864	2020-11-10 11:54:24	STANDARD	11970.00	90.00	260.00	CORRECTED	11970.00	88.92	257.55	5466.59	-875.88	-6625.57
3	1605030852	2020-11-10 11:54:12	STANDARD	11870.00	90.00	260.00	CORRECTED	11870.00	89.22	262.49	5464.87	-858.52	-6527.14
3	1605030833	2020-11-10 11:53:53	STANDARD	11770.00	90.00	260.00	CORRECTED	11770.00	90.59	262.31	5464.71	-845.22	-6428.03
3	1605030818	2020-11-10 11:53:38	STANDARD	11670.00	90.00	260.00	CORRECTED	11670.00	89.69	265.73	5465.34	-833.25	-6328.76
3	1605030803	2020-11-10 11:53:23	STANDARD	11570.00	90.00	260.00	CORRECTED	11570.00	90.12	263.86	5465.07	-824.57	-6229.14
3	1605030730	2020-11-10 11:52:10	STANDARD	11470.00	90.00	260.00	CORRECTED	11470.00	91.46	258.58	5466.55	-809.22	-6130.38
3	1604971099	2020-11-09 19:18:19	STANDARD	11270.00	90.00	260.00	CORRECTED	11270.00	88.69	264.62	5466.31	-780.37	-5932.60
3	1604968030	2020-11-09 18:27:10	STANDARD	11170.00	90.00	260.00	CORRECTED	11170.00	89.88	264.31	5465.25	-770.68	-5833.07
3	1604966504	2020-11-09 18:01:44	STANDARD	11070.00	90.00	260.00	CORRECTED	11070.00	89.08	263.97	5464.26	-760.28	-5733.62
3	1604966458	2020-11-09 18:00:58	STANDARD	10970.00	90.00	260.00	CORRECTED	10970.00	91.11	264.50	5464.53	-750.57	-5634.10
3	1604966376	2020-11-09 17:59:36	STANDARD	10870.00	90.00	260.00	CORRECTED	10870.00	89.71	258.83	5465.24	-736.16	-5535.19
3	1604966321	2020-11-09 17:58:41	STANDARD	10770.00	90.00	260.00	CORRECTED	10770.00	90.10	257.54	5465.00	-715.74	-5437.30
3	1604966272	2020-11-09 17:57:52	STANDARD	10670.00	90.00	260.00	CORRECTED	10670.00	90.96	258.51	5466.02	-694.69	-5339.55
3	1604966150	2020-11-09 17:55:50	STANDARD	10570.00	90.00	260.00	CORRECTED	10570.00	89.34	262.82	5466.25	-678.84	-5240.85
3	1604966011	2020-11-09 17:53:31	STANDARD	10470.00	90.00	260.00	CORRECTED	10470.00	89.86	258.26	5465.48	-662.06	-5142.30
3	1604965293	2020-11-09 17:41:33	STANDARD	10370.00	90.00	260.00	CORRECTED	10370.00	90.75	264.09	5466.14	-646.61	-5043.55
3	1604960350	2020-11-09 16:19:10	STANDARD	10270.00	90.00	260.00	CORRECTED	10270.00	88.82	264.75	5465.72	-637.01	-4944.02
3	1604958644	2020-11-09 15:50:44	STANDARD	10070.00	90.00	260.00	CORRECTED	10070.00	90.50	260.76	5464.85	-610.74	-4745.81

WITS ID's Tab

Data communications between computers are in a format defined by the Wellsite Information Transfer Specification (aka: WITS) One line of WITS data is specified as a 4 digit ID followed by a value. The first 2 digits of the ID specify the Record number and the remaining 2 digits are a Item number within the given Record. Typically records 01xx and 02xx are reserved for rig-specific data. Records 07xx, 08xx and 09xx are typically reserved for down-hole MWD data. For instance WITS ID 0824 specifies record “08” for “MWD formation evaluation” data and the item “24” for “Gamma Ray 1” value. [See the WITS Specification Website](#) for more information about WITS

By default the most common WITS ID's should already be set up. If there is a situation where you find a WITS ID that is needed but not already set up they can be easily added. To add a WITS ID enter it in the “**WITS ID**” box and click “**Add**”. Then click on the WITS ID in the list that was just added in order to configure



General Information

- **Enable Logging:** Check this box to enable data storage for this WITS ID
- **Name/Units:** Enter the Name and Units for the new WITS ID
- **Decimal Places:** By default this value is 2. If you want to display more decimal places change this number to the desired amount of places needed
- **Scale Factor:** If the WITS data needs to be scaled (e.g. Gamma Correction Factor) enter the value that needs to be applied here
- **Bias offset:** Normally set to zero “0”, this value will be subtracted before the scale factor is applied
- **Sensor to Bit Spacing:** Enter the bit-to-sensor distance for this WITS ID. If it is surface data then leave at 0
- **Send to AUX port:** Check this box to enable this data to be transmitted out of the AUX port
- **Send to Rig WITS Port:** If this WITS data needs to be reported to the Rig WITS System, then check this box. (NOTE: Only WITS IDs 0700 and above can be transmitted)
- **Do Not Repeat:** Use this check box to prevent transmitting the same value repetitively to the Rig WITS System (Only send once when the data is received from the Decoder)

Monitor colors – scale values

Configuration for the plots that are displayed on the real-time Dashboard monitoring screen

- **Plot Scaling:** Enter the left to right scale of the track
- **Line Color/Wrap Color:** Select the Line color and Wrap color you want the curve to be displayed as. (These color selections do not affect the curve colors of the MWD log plots, just the screen)

Depth Tracking

- **Tracks Hole Depth (default):** The system will use the current hole depth (0110) to calculate this depth for this WITS ID. Data storage is automatic, as hole depth increases data for this ID is saved to the database.
- **Use Custom WITS ID For Depth:** As the name implies, the value of another WITS ID can be used for this ID's depth. (ex: gas returns 0139 is to be used for total gas 0140 depth)

LAS Settings

- **LAS Tag:** Abbreviated description of data
- **LAS Description:** Full description of the data
- **LAS Filter:** Normally "0" (No Filter), this data can optionally be smoothed by applying a filter factor greater than "0".

Alarm Settings

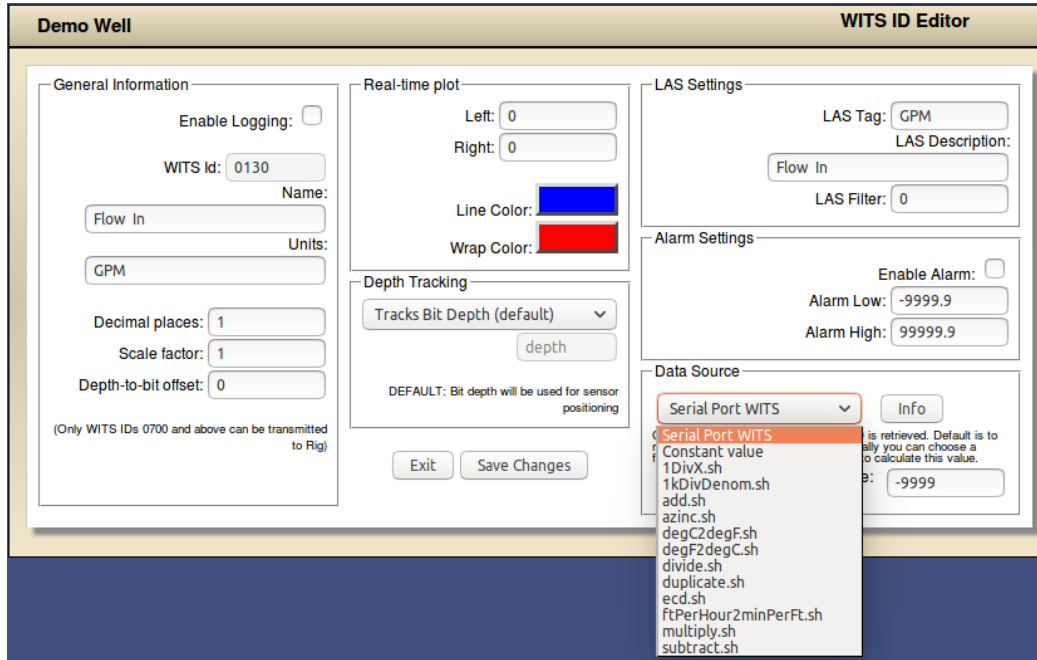
User can set minimum and maximum values for any ID. When the value reaches the limit, an alarm will go off on the monitoring page and an entry will be logged into the messaging list.

Data Source

Data for this WITS ID can be configured to either directly read its value from the serial ports (default) or it can be the mathematical result of a scripting function.

- **Data Source selections:**
 - **Serial Port WITS (default):** Data for this WITS ID is read from the serial port
 - **Constant value:** This WITS ID can be used as a constant value for a script of another WITS ID. The value entered in the "**value**" field will be the constant used for this WITS ID.
Ensure that this WITS ID is unique and is not received on any serial ports
 - All of the remaining selections are scripts which can be used to calculate the value for this WITS ID based upon the value of other WITS IDs. To find out more about each script click the "**Info**" button
- **Value:** Displays the last value received or calculated for this WITS ID. This is also the value of any IDs that are defined as "**constants**"

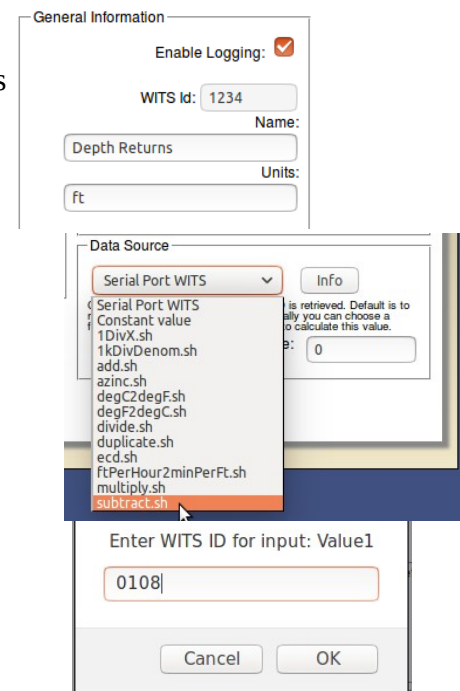
Scripting Example: Gas Depth Returns used as offset



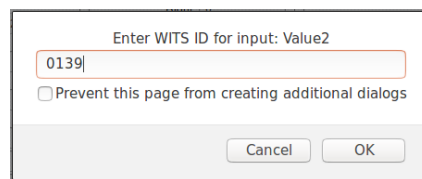
As a simple example of using scripts for calculated results take the case of gas lag depth tracking. When logging Gas (0140) the rig monitoring system may be capable of providing Depth Returns (0139) which should be used for the Gas (0140) depth. Simply selecting “**Use Custom WITS ID For Depth**” and entering “**0139**” for the ID will provide the proper depth during logging.

However in some cases the value sent for Depth Returns (0139) is an **offset depth** that needs to be subtracted from the current Bit Depth (0108) in order to be used as depth for Gas (0140). In this case the “**subtract.sh**” script function will be used.

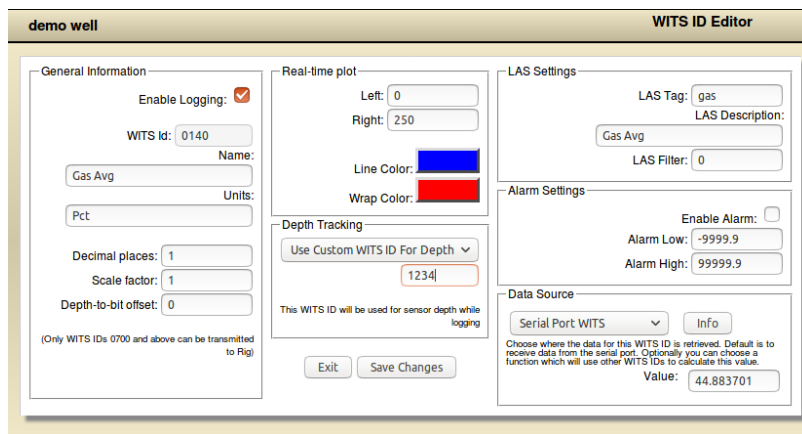
1. Create a unique WITS ID that will be the ID to use for Gas depth. In this example create WITS ID “**1234**” then open the configuration for this ID.
2. For “**Data Source**” select “**subtract.sh**” then click “**Save Changes**”
3. The program will then ask for the WITS ID for “**Value 1**” (minuend). Enter the Bit Depth ID “**0108**”



- The program will then ask for the WITS ID for “**Value 2**” (subtrahend). Enter the Depth Returns ID “**0139**”



- Next, edit the WITS ID for Gas “0140”
- Under “**Depth Tracking**” select “**Use Custom WITS ID For Depth**” and enter “**1234**” and “**Save Changes**”



More information:

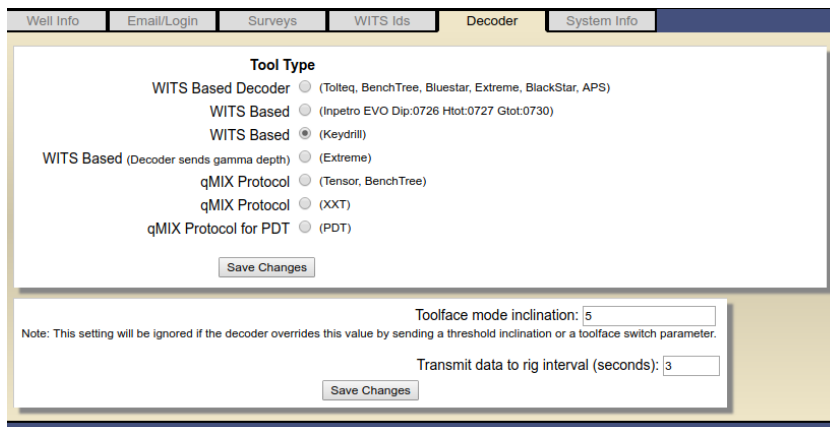
- ✓ All WITS IDs used for input to the scripts must be defined in the database with logging enabled. Missing WITS IDs will result in a -9999.0
- ✓ All scripts are executed every 1-5 seconds and only if new data has been received
- ✓ Results from one script can be used to calculate other values (ex: The script results from 9101 can be used to calculate the value for WITS ID 9102)
- ✓ Script calculations are executed in order of the value of the WITS ID (ie: 9101 will be calculated before 9102)
- ✓ **IT IS VERY IMPORTANT TO USE WITS IDS THAT ARE UNIQUE** (do not choose a WITS ID that is being received from the serial port(s))

Common Scripting Functions (ECD, temperature conversion)

- **ECD:** Use the script “*ecd.sh*”
- **Temperature:** Use either “*degC2degF.sh*” or “*degF2degC.sh*” to convert temperature units
- **Inversion:** 1DivX.sh
- **Calculate inclination based on Axial G and Total G values:** azinc.sh

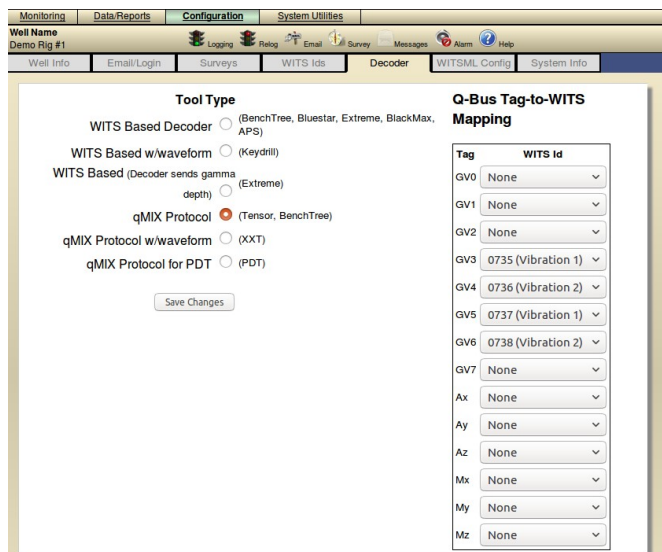
Decoder Tab

- **Tool Type Selection:** Choose the selection that matches the MWD surface decoder
- **Tool Face Mode Inclination:** This defines the inclination at which the toolface dial (Rosebud) switches from Magnetic to Gravity toolface mode
- **Send WITS Output Timer:** This is how often the WITS data is sent out to the Rig WITS system from Polaris. Three seconds is the default value.



The screenshot shows the 'Decoder' tab in the software interface. It contains a 'Tool Type' section with several radio button options: 'WITS Based Decoder' (Toileq, BenchTree, Bluestar, Extreme, BlackStar, APS), 'WITS Based' (Inpetto EVO Dip:0726 Htot:0727 Gtot:0730), 'WITS Based' (Keydrill), 'WITS Based (Decoder sends gamma depth)' (Extreme), 'qMIX Protocol' (Tensor, BenchTree), 'qMIX Protocol' (XXT), and 'qMIX Protocol for PDT' (PDT). Below these is a 'Save Changes' button. At the bottom, there is a 'Toolface mode inclination' field set to 5 and a 'Transmit data to rig interval (seconds)' field set to 3, both with 'Save Changes' buttons. A note states: 'Note: This setting will be ignored if the decoder overrides this value by sending a threshold inclination or a toolface switch parameter.'

- **Resistivity and Vibration GV Tags:** In order to support Q-Bus GV (Generic Variables) tags they must first be assigned a WITS ID. In the decoder configuration select the WITS ID to assign each GV tag to.



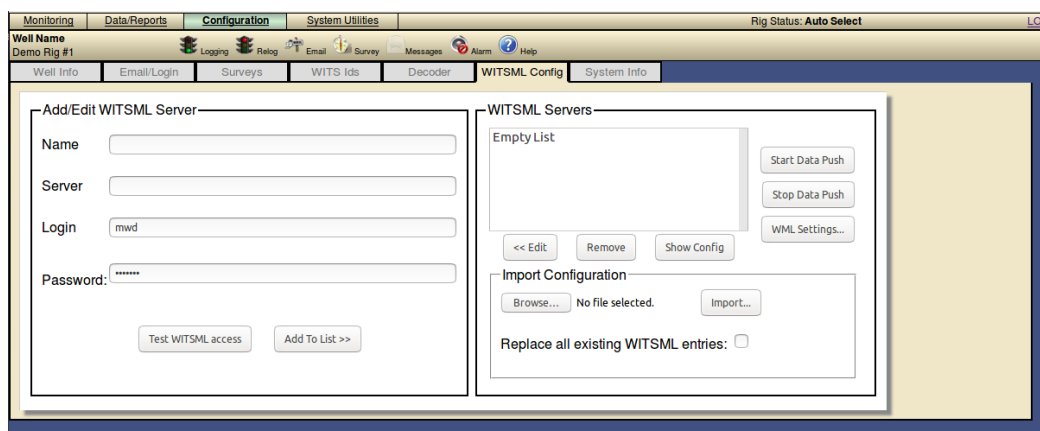
The screenshot shows the 'Decoder' tab with the 'Q-Bus Tag-to-WITS Mapping' section expanded. It displays a table with 'Tag' and 'WITS id' columns. The tags listed are GV0 through GV7, Ax, Ay, Az, Mx, My, and Mz. Each tag has a dropdown menu for selecting a WITS ID. The current selections are: GV0 (None), GV1 (None), GV2 (None), GV3 (0735 (Vibration 1)), GV4 (0736 (Vibration 2)), GV5 (0737 (Vibration 1)), GV6 (0738 (Vibration 2)), GV7 (None), Ax (None), Ay (None), Az (None), Mx (None), My (None), and Mz (None). A 'Save Changes' button is located at the bottom left of the mapping section.

- Afterwards, go to the WITS Ids tab and ensure that the IDs exists for the GV tags mapped

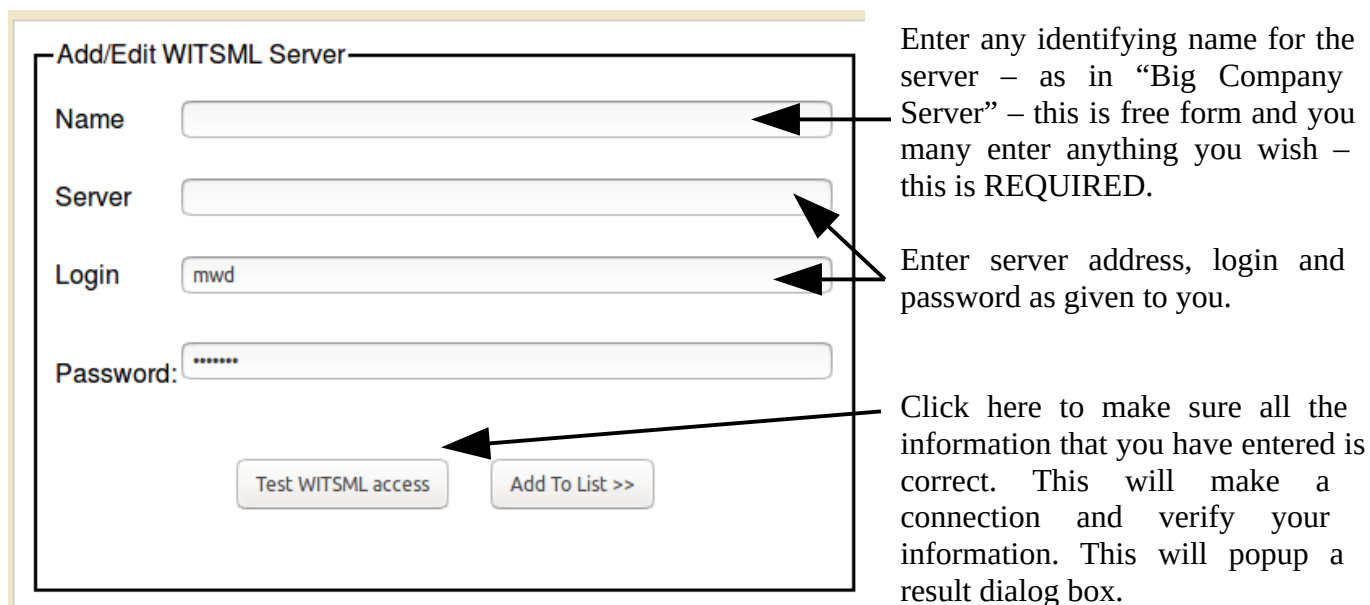
WITSML Tab

For a quick info on WITSML, please see this Wikipedia entry [http://en.wikipedia.org/wiki/Wellsite_information_transfer_standard_markup_language].

The Polaris system can be configured to push both survey and depth log data in real time to as many as four different WITSML servers. Click on “Configuration” section on top of the screen and then select the “WITSML Config” tab.



To add a new WITSML server, please request server information, login, and password from the WITSML vendor. WITSML server name almost always begins with http:// or https://. It is our suggestion that you insist on HTTPS:// (see the “S” at the end – it indicates SECURE server). This way you ensure that the data being pushed cannot be sniffed by unauthorized software or personnel.



This is the right side of the screen, where the WITSML Servers that are setup can be viewed. You can add as many as four servers at one time.

WITSML Servers

Empty List

<< Edit

Remove

Show Config

Start Data Push

Stop Data Push

WML Settings...

Import Configuration

Browse...

No file selected.

Import...

Replace all existing WITSML entries: ☐

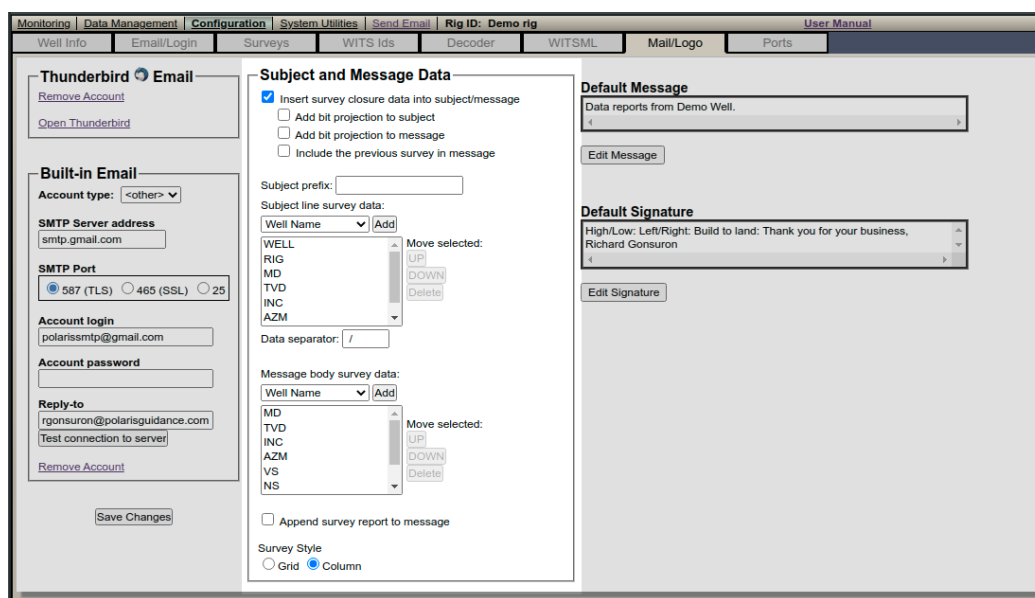
Mail/Logo Tab

The system has the capability to automate the generation of reports, plots and data files. Then once these files are generated the user has multiple options for sending these attachment files to the list of contacts in the configuration. The options to send Email are:

- Using the built-in Email client with publicly available SMTP service providers that only require a user name and password to login
- For more advanced SMTP servers that require higher security logins the use of the Thunderbird application is required. The Thunderbird application is seamlessly integrated with the Polaris system for easy operation. After generating the attachments the Thunderbird message composer automatically opens with the contents of the message and all attachments.

The Polaris Logging System for Windows WSL has the added ability to send Email through Microsoft's Exchange server (Office365/Outlook) built into the Polaris WEB Client application.

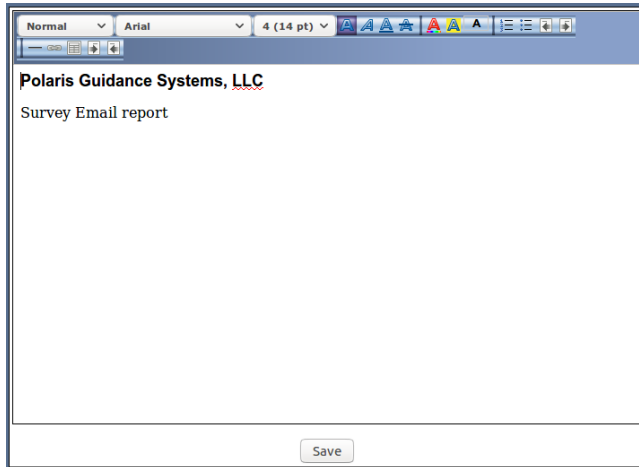
Subject and Message Data



The Email feature can automatically create subject lines and message text by simply checking the boxes corresponding to the data you wish to include.

- **Subject Line Survey Data:** Using the drop down menu, and the ordering function, add and arrange the subject line data as required.
- **Data Separator:** Use this function to enter the appropriate character(s) that is required by the company to separate the data on the Subject Line
- **Message Body Survey Data:** Select the survey that is to be included in the body in the email, and arrange the data as defined above (#7)
- **Survey Style:** The survey data can be arranged as a grid or column

- **Default Message:** A custom standard email message can be created to be sent out in the body of the email when the logs are sent.



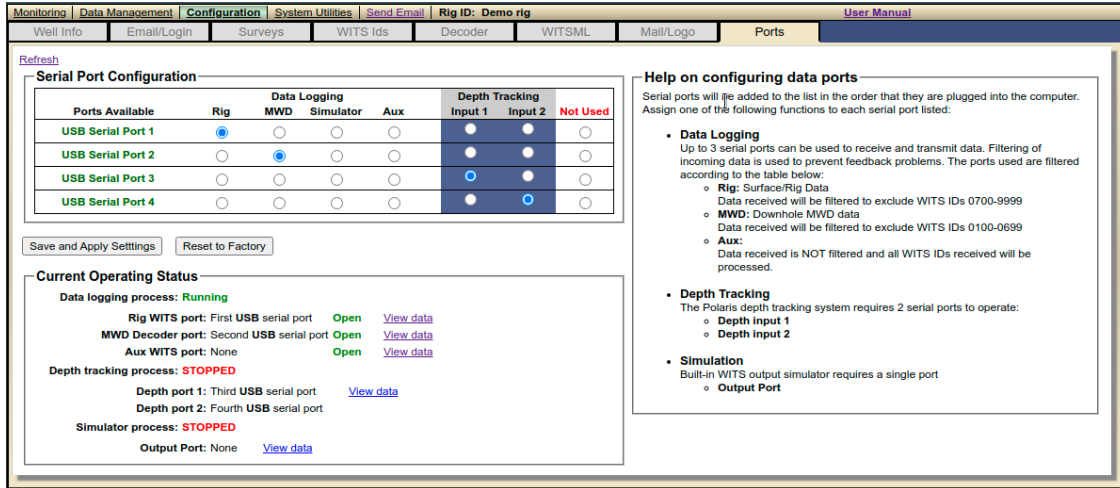
Message and signature editor

- **Signature:** Your email signature can be loaded here to be used when emails are sent from the Polaris system
- **Save Changes:** If any setting are changed in this section you MUST click “Save Changes” in order for those new setting to take effect
- **Report Logos:** Inserts a Polaris logo, or company logo, that is uploaded. The logo(s) can be attached to the reports being sent out in either the top left, top right, or both on the reports that are generated
 - **Logo Files:** A logo can be selected for the Left and Right sides of the PDF logs. A default Polaris logo is already uploaded, and should not be changed unless otherwise specified
 - **Changing the Logo:** Click “Browse” and select the logo to be used from your laptop (MUST be a jpg image). Once loaded click “Save”
 - **Logo Size:** When uploading a logo, cropping and resizing the logo to a minimally necessary size will impact both the size of the file and the speed of which the file is emailed
 - **Save Logo to Desktop:** The Polaris, or company logo, can be uploaded to the computer’s desktop by using the “Save Logo to Desktop” button under the “Current Left-side Logo” section
 - **Use Polaris Logo:** If there is not a company logo available to attach to reports, the Polaris logo is available for use by clicking the “Use Polaris Logo” button located in the “Current Left-Side Logo” section
 - **Right-Side Logo:** A logo can be uploaded and attached to the upper right side of reports by uploading a logo in the “Select Right-Side Logo File” field underneath the section for uploading a logo to the left-side of the report

Ports Tab

(Ubuntu Linux Only)

This control panel is used to configure the function of each available COM port. Documentation on the usage and the filtering of data is provided on the right-side pane.



Ports Available	Rig	Data Logging			Depth Tracking		Not Used
		MWD	Simulator	Aux	Input 1	Input 2	
USB Serial Port 1	☒	☐	☐	☐	☒	☒	☐
USB Serial Port 2	☐	☒	☐	☐	☒	☒	☐
USB Serial Port 3	☐	☐	☐	☐	☒	☐	☐
USB Serial Port 4	☐	☐	☐	☐	☒	☒	☐

Current Operating Status

Data logging process: **Running**

Rig WITS port: First USB serial port **Open** [View data](#)

MWD Decoder port: Second USB serial port **Open** [View data](#)

Aux WITS port: None **Open** [View data](#)

Depth tracking process: **STOPPED**

Depth port 1: Third USB serial port [View data](#)

Depth port 2: Fourth USB serial port

Simulator process: **STOPPED**

Output Port: None [View data](#)

Help on configuring data ports

Serial ports will be added to the list in the order that they are plugged into the computer. Assign one of the following functions to each serial port listed:

- Data Logging**
Up to 3 serial ports can be used to receive and transmit data. Filtering of incoming data is used to prevent feedback problems. The ports used are filtered according to the table below:
 - Rig:** Surface/Rig Data
Data received will be filtered to exclude WITS IDs 0700-9999
 - MWD:** Downhole MWD data
Data received will be filtered to exclude WITS IDs 0100-0699
 - Aux:**
Data received is NOT filtered and all WITS IDs received will be processed.
- Depth Tracking**
The Polaris depth tracking system requires 2 serial ports to operate:
 - Depth input 1
 - Depth input 2
- Simulation**
Built-in WITS output simulator requires a single port
 - Output Port

The **Polaris Logging System for Windows** handles the COM port configurations in the Polaris WEB Client application. Start the application and open the **Menu** on the top-right to configure the COM port assignments.

Testing serial port communications

A simple serial port test that verifies cables and adapters are functioning properly

- Connect a null-modem cable between the serial ports used for “**Rig**” and “**MWD**” above
- Click on the [Monitoring section](#) at the top of the WEB page
- Open the [Rig WITS monitoring tab](#) and click **Send WITS data**. Enter a message then press OK
- Open the [Decoder monitoring tab](#) to check if the message was received
- Click “**Send WITS data**” then enter a message and press OK
- Open the [Rig WITS monitoring tab](#) again to check if the message was received

If the message was received on both ends then the serial ports are working properly. If not then replace the serial port adapters and cables until the failed component is found.

Monitoring Section



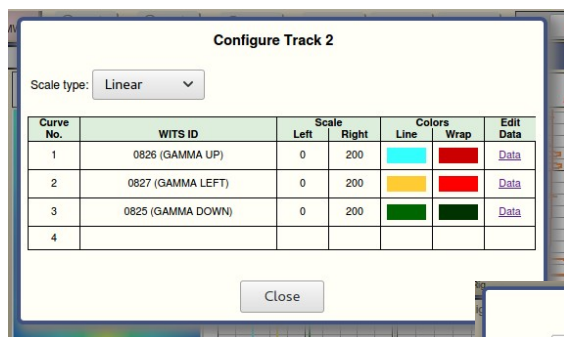
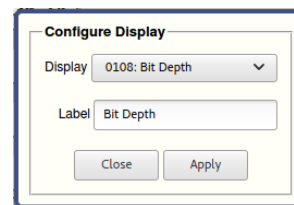
The monitoring section tabs will be the main pages while logging data. This has all of your Real Time tracks, Logging On/Off, Rig Messaging, Alarms, Auto Email, and quick access to the saved surveys.

Dashboard Tab

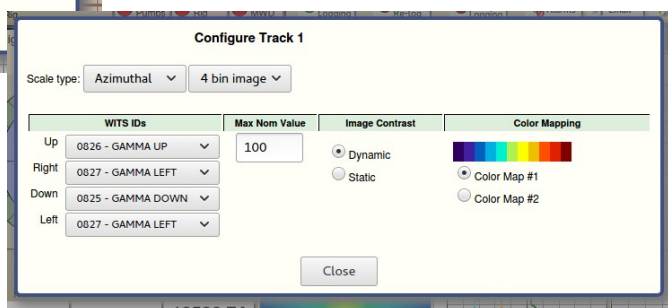


Main screen used while logging data. This will show your survey data, Rosebud, depth data, and surface data from the rig monitoring system.

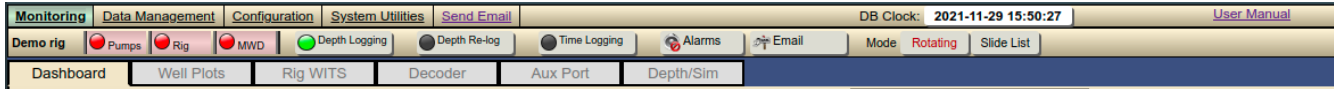
- **Data Boxes:** To view different data points click on the box you want to change, and a pop up window will appear. Select the WITS ID you want to see and then apply
- **Data Tracks:** Click on any of the data tracks to assign WITS ID's to be displayed



Each track can also plot azimuthal images



The center row in the header will contain indicators and buttons to control most used aspects of logging data.



Indicator lights

- **Pumps:** Monitors pump pressure to determine if the pumps are running
- **Rig:** Monitors communications with the Rig monitoring system computer
- **MWD:** Monitors communications with the MWD surface decoding computer

Buttons

- **Depth Logging** – Enables data logging as the hole depth increases (single direction, down only)
- **Depth Re-log** – Enables data logging as the drill pipe is raised or lowered (upward or down)
- **Time Logging** – Enables time-based data logging of all data received from both all serial ports
- **Alarms** – Turns on/off audible alarms
- **Email** – Opens the Email composer window
- **Rotating/Sliding** button/indicator – Using WITS ID 0012, this button will either write a “0” or a value of “1” to indicate if Rotating(0) or Sliding(1). Using various plot features to display a slide indicator on your plot.

Re-Logging Data

During normal logging operations the program will track Hole Depth as it increments deeper into the formation. Hole Depth should always increment and never go back upwards.

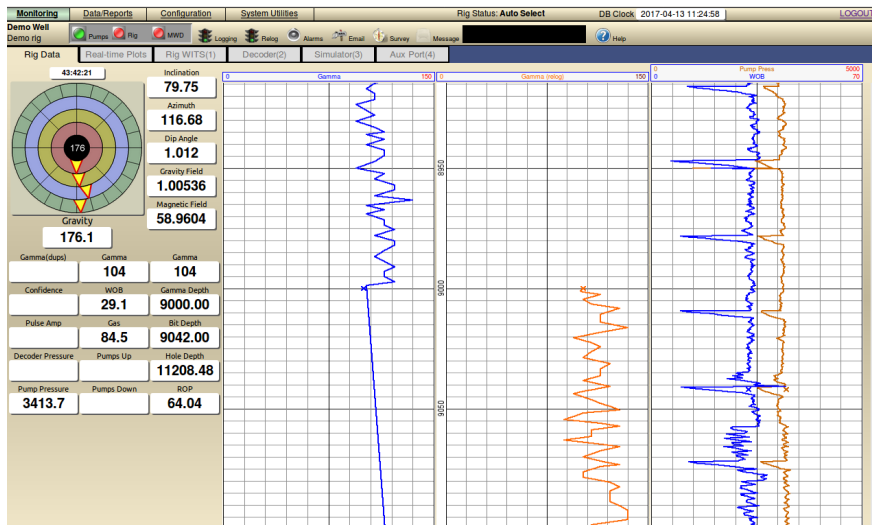
If required, Re-logging can be used to re-log a portion of the hole or to fill in gaps in data due to loss of signal while drilling. While Re-log is enabled the program will track the Bit Depth in both directions and will automatically store the data in an alternate WITS ID that is automatically created for you.

The differences are:

	Normal Logging	Re-log Enabled
Sensor Depth Tracking	Hole Depth is used	Bit Depth is used
WITS ID (ex: gamma)	0824	5824 (alternate ID automatically created by the program)
Overwriting	YES, Will overwrite data if the hole depth reverses direction	NO, Rather than overwriting original data an alternate ID is used for storage

WITS IDs in the range of 5700 thru 5999 are reserved for the Re-log function. All MWD and Directional WITS records are duplicated for re-logging with these IDs.

Records 0700-0799 will be duplicated to 5700-5799
Records 0800-0899 will be duplicated to 5800-5899
Records 0900-0999 will be duplicated to 5900-5999



For instance, if WITS ID for temperature being logged is 0835 then the duplicate WITS ID for Re-log storage would be 5835. The system will automatically create the duplicate IDs for all Directional and MWD records that are enabled.

Well Plots Tab

Continuously plots all data logged by the system. This is a view only feature that allows you to scroll back through all data logged as a quality control check and will only display the same tracks that you have selected to display on the Dashboard Tab

Rig WITS Tab

The next 3 tabs are designed for serial port communications and each operate as below:

- Check to make sure that the status is showing “**Open**”
- The “Data Received History” will show all of the WITS IDs being received
- Select “Raw” to display the raw data being received from the serial port
- Select “Details” to display a history of data received
- The “Data Transmitted” displays the WITS IDs being transmitted out the serial port
- Use the “**Send WITS Data**” button to manually send a WITS ID packet the serial port. This diagnostic tool is useful in verifying communications between computers. Basic serial port diagnostics can be found in the [Ports configuration tab](#)

Decoder and Aux Port Tabs

Same as the Rig WITS tab but it monitors the other serial ports as assigned in the [Ports configuration tab](#).

Depth/Sim Tab

This tab has dual functions.

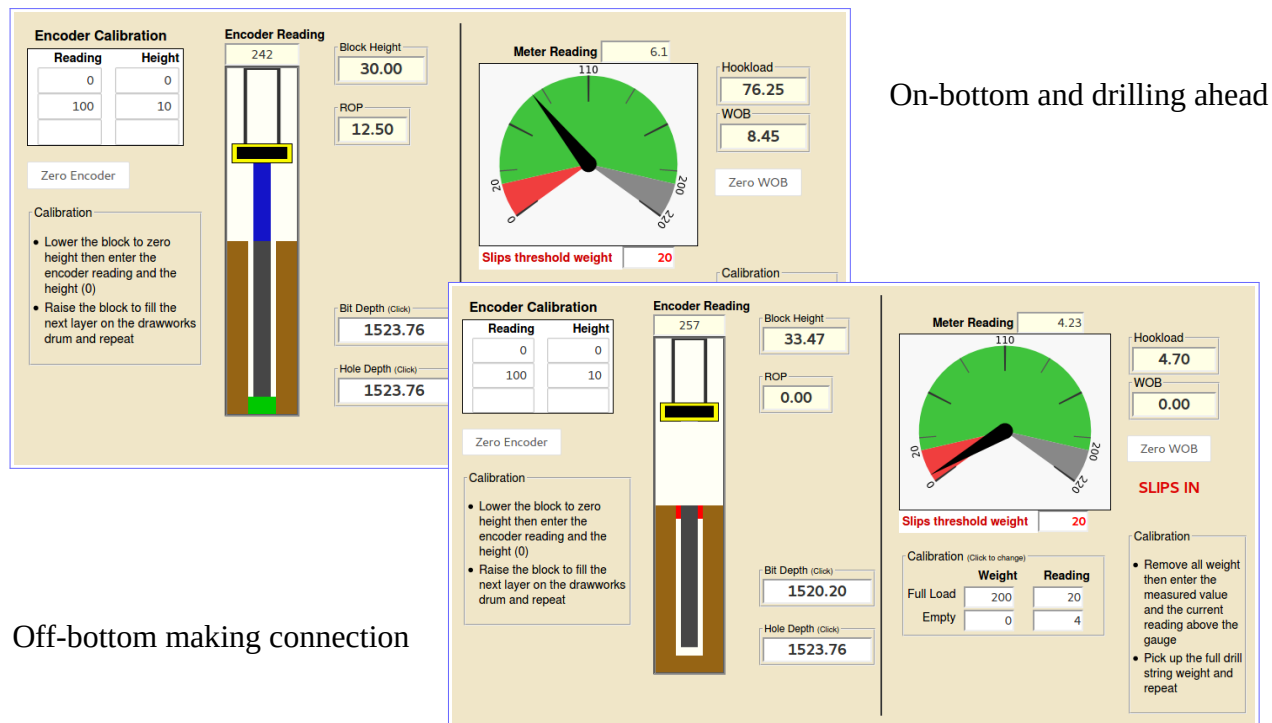
Simulator (Ubuntu Linux only)

First it can be used to test serial ports by outputting WITS data through the serial port which can then be routed into another serial port using a null-modem cable. No WITS data will not be sent out initially. Once values are set for the Hole Depth, Bit Depth, and Drill Rate the data will begin sending randomly generated WITS data values out the simulator serial port assigned to this function. [See Ports Tab configuration for more information](#)

Depth Tracking System

The other function that this tab performs is providing a graphical user interface to the Polaris depth tracking equipment. There should be 2 null-modem cables between the DTS box and the Polaris computer using USB to Serial adapter(s). Then refer to the [Ports Tab configuration](#) for assigning serial ports to the DTS.

Once the DTS box is plugged in and powered on clicking the “**Start/Stop**” button will enable or disable the usage of the DTS. When enabled the DTS software will communicate with the DTS box via the 2 supplied null-modem cables. One cable is for Hookload and the other cable is for Depth Encoder. If either of these two devices fail to communicate it will be displayed below the graphics.

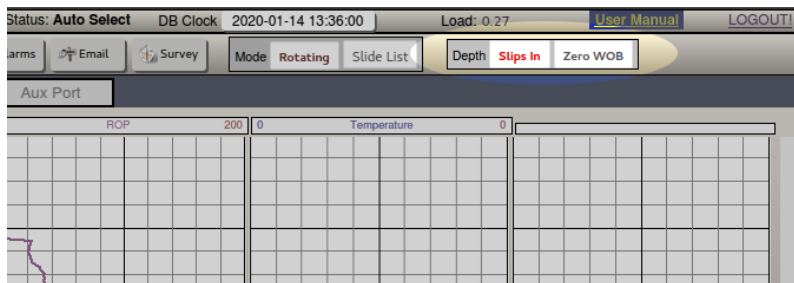


DTS Operation

- Sensor calibration is described in the user interface
 - Encoder calibration starts by setting the lowest block level to zero then entering a height and encoder reading for each layer on the draw-works drum
 - Hook-load calibration involves setting the weight and reading for lightest weight (no drill string, just the blocks) and the heaviest load (drill string hung off-bottom)

- **Hole Depth** and **Bit Depth** can be adjusted by simply clicking on the data boxes for each
- **Zero Encoder** button will set the **Encoder Reading** to 0
- **Slips Threshold Weight** is the amount of measured weight that the automatic slips detection triggers
- **Zero WOB** is used to set the total string weight while off-bottom

When operating the main Dashboard tab will have quick DTS controls in the upper-right corner of screen



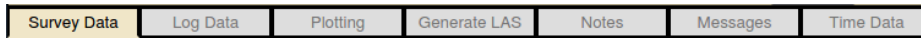
The **Slips In/Out** button performs a manual over-ride of the automatic slips detection. When the slips are “out” the bit depth will be tracking. When the slips are “in” the bit depth will remain in-place.

The **Zero WOB** function is used to set the drill string weight after each connection is made and while the bit is off-bottom.

Data Management Section



Survey Data Tab



After a complete set of survey data has been received from the MWD decoder open the “Data/Reports” section and the survey input data will be displayed at the top in “Captured Survey Data”. Review the data then click “Add Survey” button to save this information to the database.

The following menu items are available:

- **Add Projection:** Add a projected survey of where the drill bit is located in respect to the tool on the drill string. A pop-up window will be displayed for the user to input the measured depth of the projected survey. Two types of projections are available:
 - **Straight-Line:** calculates the projected survey without any build or turn (constant inc)
 - **Last Build/Turn:** projection assumes the last build/turn rate continues to the projected survey
- **Import Surveys:** Surveys can be imported from either a CSV or LAS file
- **Export Surveys:** Multiple formats including PDF, XLS and CSV
- **Plot Surveys:** Choose from various plots that can used as a graphical representation of the survey data
- **Configure:** Various survey related items
 - **Surveying:** Links to the configuration page for surveys
 - **Tie-in Survey:** Edits the very first survey input data
 - **Delete Surveys:** Delete a range of surveys from the database
 - **Data Columns:** Manage the storage of survey data in the database
 - **Survey Data:** Allows the user to change the labels used for display columns and reports
 - **User-defined data input:** Used for manually entered data to be stored with each survey
 - **WITS data capture:** Used to capture the current values for the specified WITS IDs and stored along with the survey data

Log Data Tab



The log data, or data that is stored in the database, can be manipulated in various ways.

Function Menu: Various functions related to survey data

- **Import data from CSV or LAS file:** This function will store data into the WIT IDs selected. Time-based CSV file formats are automatically recognized as time-depth correlation data.
- **Memory Correlation Editor:** Shift the timestamps, change bit spacing or scaling of imported time-based memory data
- **Batch Settings Editor:** Configure scale and bit spacing for multiple WITS IDs
- **Export Data:** Export each WITS ID data into CSV files

The data editor for each WITS ID contains the following functions:

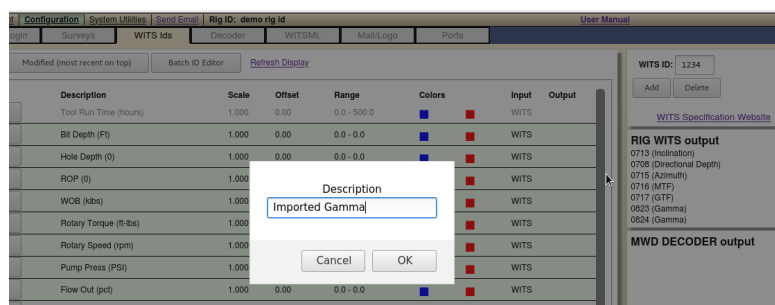
- **Edit Data:** Used to visualize and edit data values store in the database. Data values can be hidden from view by using the “Hide” checkbox. A range of data can be hidden by holding down the Shift key. The “Add Data” button is to enter new data one-by-one.
- **Hide Depth Range:** to quickly select a range of data to be hidden
- **Delete Depths:** Delete Depth Range will delete/remove data form the database.
- **Filter Value Range:** Will hide all data that is outside of the min/max limits set. Useful for hiding erroneous data quickly.
- **Move Depths:** Moves all data within the range specified to a new starting depth
- **Copy Depths:** To copy data to another WITS ID
- **Rescale Data:** To scale all or part of data to new values
- **Import Data:** To import data from various file formats
(NOTE: The “Function Menu” contains a more comprehensive import function for this process)

Importing Time-based CSV Files

The example below outlines the steps to take when importing time-stamped data from a CSV formatted file.

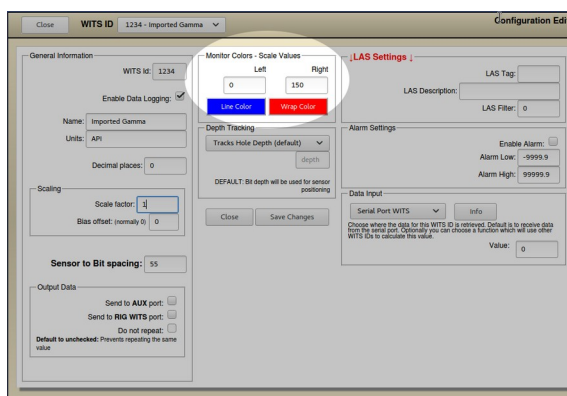
Create WITS ID for imported data

A new WITS ID must be created to hold the imported data. It can be any WITS ID but try not to use anything less than **1000**. Here we will use **1234** and give it a description.



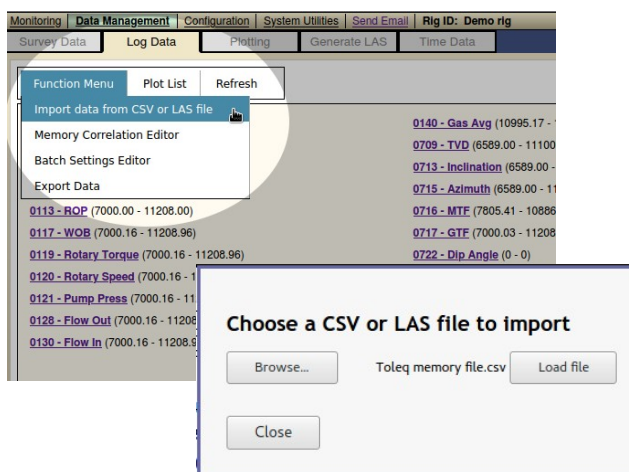
Configure the new WITS ID

Usually the scale and bit offsets are not too important since the data will be scaled before writing to this WITS ID. However the left/right monitor scales should be the same as the real-time data so they can be easily compared visually.



Load the CSV data file

In the Data Management section open the Log Data tab and click the **“Import data from CSV or LAS file”** menu item.



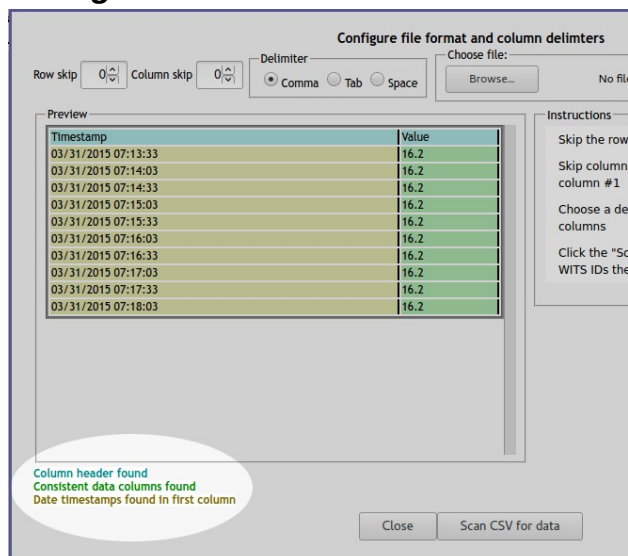
Specify the starting row and column for scanning data

After the file is loaded verify the starting row and column selection.

Use the following as a guide:

- The first column must **always** be either depth measurements or time stamps
- The system will automatically determine the type of data in the first column. In this example we are using time stamps.
- The first row is **always** considered to be labels for each of the columns of data

Use the “**Row skip**” and “**Column skip**” values to adjust the file scanning start positions.



Configure file format and column delimiters

Row skip: 0 Column skip: 0 Delimiter: ☒ Comma ☐ Tab ☐ Space

Choose file: No file

Preview:

Timestamp	Value
03/31/2015 07:13:33	16.2
03/31/2015 07:14:03	16.2
03/31/2015 07:14:33	16.2
03/31/2015 07:15:03	16.2
03/31/2015 07:15:33	16.2
03/31/2015 07:16:03	16.2
03/31/2015 07:16:33	16.2
03/31/2015 07:17:03	16.2
03/31/2015 07:17:33	16.2
03/31/2015 07:18:03	16.2

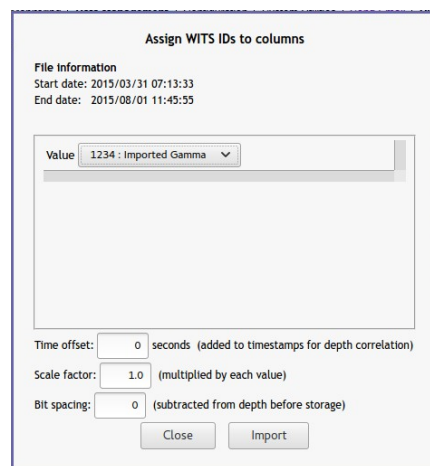
Column header found
Consistent data columns found
Date timestamps found in first column

Scan file and choose WITS IDs for storage

After scanning the CSV file column labels will be listed along with a selector to choose which WITS ID to store each column of data. To skip columns simply leave the selection blank and only choose a WITS ID for the columns to be imported.

In this example there was only a single column of data and will be stored in the WITS ID we created in the first step.

The system always stores data based on measured depth. Depending on the type of data in the first column the system either stores the data directly to the database or it will correlate each time stamp to a measured depth then write the data to that depth.



Assign WITS IDs to columns

File information
Start date: 2015/03/31 07:13:33
End date: 2015/08/01 11:45:55

Value: 1234 : Imported Gamma

Time offset: 0 seconds (added to timestamps for depth correlation)

Scale factor: 1.0 (multiplied by each value)

Bit spacing: 0 (subtracted from depth before storage)

Merging the imported data with real-time data

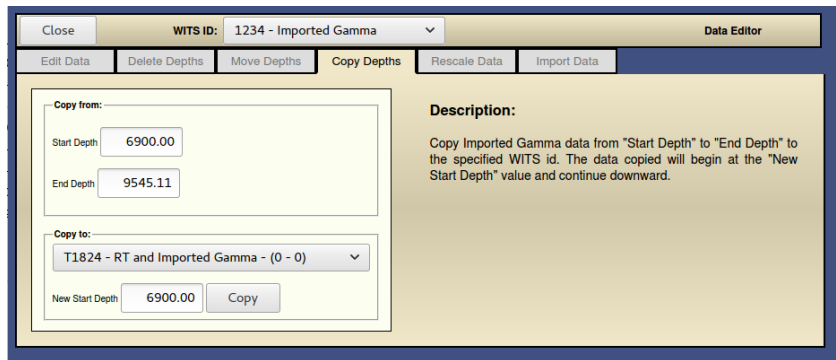
Once the time-stamped data has been converted to depth-based data then it can be treated as any other depth-based data acquired in real-time. However it is recommended that you keep the imported data and the real-time data separated. To merge these two sets of data create another WITS ID to hold the merged data.

In this example

- The WITS ID for real-time data is the usual **0824**
- We created WITS ID **1234** for the time-stamped imported data
- Now WITS ID **1824** is created to contain merged data from 0824 and 1234

To merge the two WITS IDs:

- Open the editor for each WITS data (0824 and 1234)
- Use the “**Copy Depths**” tab to selectively copy the data to the new WITS ID 1824



Close WITS ID: 1234 - Imported Gamma Data Editor

Edit Data Delete Depths Move Depths **Copy Depths** Rescale Data Import Data

Copy from:

Start Depth 6900.00

End Depth 9545.11

Copy to:

T1824 - RT and Imported Gamma - (0 - 0)

New Start Depth 6900.00 Copy

Description:

Copy Imported Gamma data from "Start Depth" to "End Depth" to the specified WITS id. The data copied will begin at the "New Start Depth" value and continue downward.

Plotting Tab



Header Information

The data for the header of each plot configuration is entered in using this editor. The layout of the header editor roughly corresponds to the layout of the actual printed page

Section 1: Log Main Header Information

- **Plot Title:** This will be the title on the Log Header. By default it's the Rig Name_Well Name.
- **User Defined Labels:** The user can define up to 8 lines of labels with corresponding descriptions

Section 2: Log Information

- **Log Measurements:** Description of the data being logged (e.g. Gamma).
- **Depth Measured From:** This is the 0' mark of where the depth will be measured from. Typically the Drill Floor or you can use Driller's Depth.
- **Max Temperature:** This will be the maximum temperature recorded in Real Time. The value can be taken from the Accepted Surveys.
- **Start/End Depth:** The Start Depth will be the Measured Depth when drilling starts. The End Depth will be the Depth at TD.
- **Start/End Date:** This will be the start and end date of the well.

Section 3: Casing and other Drilling Parameters

- **Casing Depth/Size:** Enter the casing size and depth. Info should be available on Mud Report or from Company Man.
- **Mud Type:** Enter the mud type being used (Water Based or Oil Based)
 - **Density:** Enter the mud weight of mud being used
 - **Viscosity:** Can be found on mud report
 - **Rm/Rmf/Rmc:** Values not applicable unless resistivity tools are being used
- **Elevations:** Enter the elevation of the Kelly Bushing, Drill Floor, and Ground Level Elevations.
 - Kelly Bushing and Drill Floor elevations will be the same.
 - Ground level elevation will be the elevation above Mean Sea Level of the rig location.

Section 4: Run Summaries

- **Offsets:** Enter in the Survey and Gamma offsets for each run.
- **Depths:** Start Depth of the run will be the Hole Depth at the time when drilling starts. The End Depth will be the Hole Depth when the run is completed.
- **Dates:** Enter the start and end dates of each run as well as the time drilling started and ended.
- **Additional Runs:** If an additional run needs to be added (e.g. Run 11), click the "Add Run" button located at the bottom left of the pop- up window

Plot Labels

If a label needs to be added at a certain depth, use the “Edit Plot Label” function to bring up a label that will be tagged to the determined depth.

- Enter the predetermined depth in the “Depth” field
- Choose the text alignment (“Align text” drop down menu)
- Select the track that the label that will have the label posted
- Enter the text to appear on the label in the “Text” field
- Click “Add Label”

Mud Resistivity Calculator

Used to calculate R_{mf} and R_{mc} for the header information using the current mud weight and R_m provided by the mud logging engineer

Template Files

These files are provided as examples to use in designing a custom plot header using a Spreadsheet application. The templates were built using Apache Open Office (LibreOffice in Ubuntu) and are stored in a standard Open Document format. Some templates provide database access for well information to be updated automatically. To use templates download and rename each file from the system. Then double-click on the file to open in LibreOffice. LibreOffice will ask “***This file contains links to other files. Should they be updated?***” Answering “yes” will allow the template to access the database and fill in the well information. Answer “no” if you wish to enter the well information manually. Modify the example templates as needed including any company logos that can be drag-and-dropped into place.

Uploaded user files

Files can be uploaded and stored on the Polaris system. Files that are uploaded are automatically converted to PDF if they contain a spreadsheet file extension. (.xls, .xlsx, .ods, etc) Any files that are in PDF format can be included with your plot configuration using the **PDF Plot Builder**. (see Plot Configuration below) Optionally, each PDF file can have a depth scale placed on it for each type of plot generated. Any files that are uploaded to the system are backed up with the database.

Depth Scale

Choose a PDF file from the **Uploaded user files** list then click “**Depth Scale**” to open the editor.

[illegible]

Click anywhere on the image to place a depth scale.

After placing the depth scale click “**Save Position**” so that each time this file is plotted the appropriate depth scale will be inserted at that position.

The position for each file name is stored permanently in the database so that each time that a file by that name is uploaded it will remember it's depth scale position.

Custom Headers

Building custom headers for well plots allows the user to incorporate their own style and uniqueness. It works by merging multiple PDF files into a single presentation. The steps to generate a custom header are:

- Create a document using any standard office application. Templates are provided for a quick start in creating a custom header

Monitoring

Data Management

Configuration

System Utilities

Rig Status: Auto Select

User Manager

Demo Rig: Demo Well - Focus Gamma

Survey Data

Log Data

Plotting

Generate LAS

Notes

Messages

Time Data

General Plot Information

Edit Header Information

Edit Custom Header

Edit Plot Labels

Mud Resistivity Calculator

Plot Configurations

1 Inch MD	Edit	Delete
1 Inch TVD	Edit	Delete
2 Inch MD	Edit	Delete
2 Inch MD AZIGR	Edit	Delete
2 Inch TVD	Edit	Delete
5 Inch MD	Edit	Delete
5 Inch TVD	Edit	Delete
azimuthal gamma plot	Edit	Delete
Relog gamma 5 inch	Edit	Delete
VS	Edit	Delete

Name:

Add plot configuration

User Files

Templates (Download and Edit)

Header_Only.ods

Download

Upload file(s)

Browse...

No files selected.

Upload (Click upload after selecting files)

Uploaded User Files

Depth Scale

Download

Delete

Preview

Information

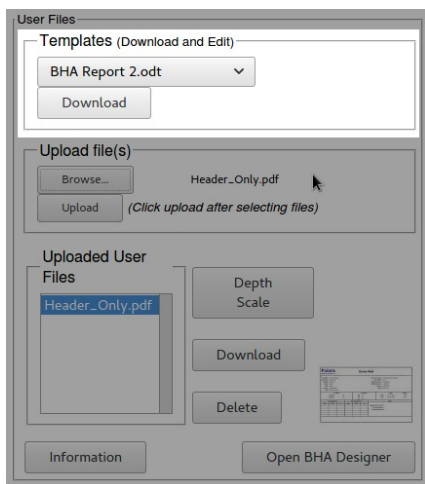
Open BHA Designer

- Convert the document to PDF and store it in the Polaris database
- Configure Polaris to insert a depth scale on the PDF header at a defined position
- Configure each plot to merge the custom header with the plot tracks below

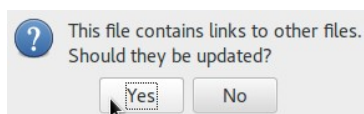
The following example illustrates how to generate a custom header

Template Files

These files are provided as examples to use in designing a custom plot header using a Spreadsheet application. The templates were built using Apache Open Office (LibreOffice in Ubuntu) and are stored in a standard Open Document format. Some templates provide database access for well information to be updated automatically.



To use a template download it to your Desktop then double-click on the file to open in LibreOffice. LibreOffice will ask ***“This file contains links to other files. Should they be updated?”***



- Answering “yes” will allow the template to access the database and fill in the well information.
- Answer “no” if you wish to enter the well information manually.

Be aware that the well information can only be read if the file is opened on the same computer as the Polaris database. Otherwise it will remain blank.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1																							
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
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20																							
21																							
22																							
23																							
24																							
25																							
26																							
27																							

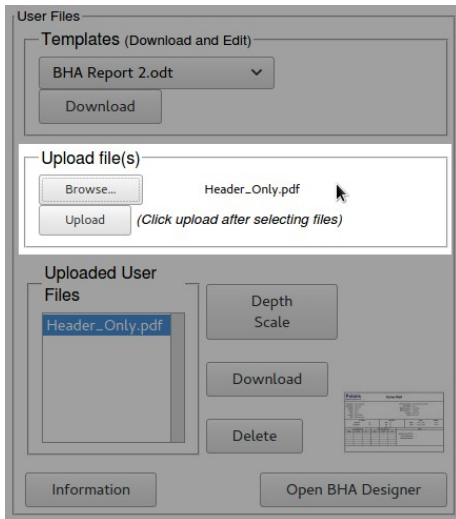
Modify the example templates as needed including any company logos that can be drag-and-dropped into place.

When completed use the File Menu and select **“Export as PDF...”** to save the PDF file to your Desktop.

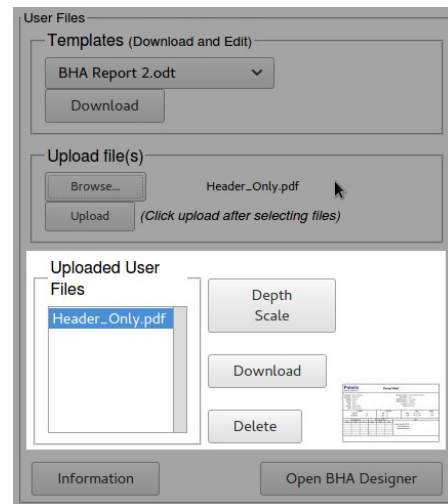
Uploaded user files

Files can be uploaded and stored on the Polaris system. Any files that are uploaded to the system are backed up with the database.

Our next step is to click the **“Browse”** button and select the PDF file created from the LibreOffice Spreadsheet. Click the **“Upload”** button to store the PDF file in the Polaris system.



Once the file is uploaded it will show up in the **“Uploaded User Files”** list.

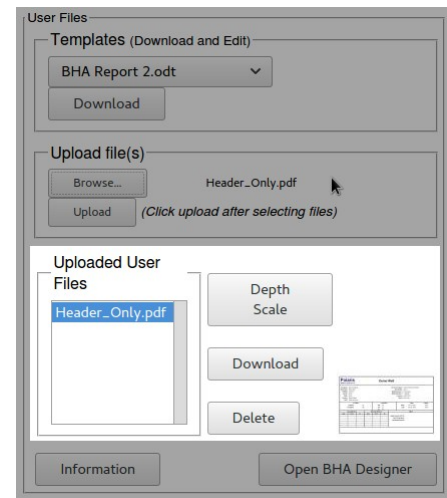


Depth Scale

The header used for each plot is usually the same but the “Depth Scale” for every plot is different.

The next step is to configure where the Depth Scale will be placed on each PDF header that is generated. The system will determine which scale to print. (ex: MD 1:100 or TVD 5:100)

Select the PDF file in the **Uploaded user files** list then click the “**Depth Scale**” button to open the placement editor.



Click anywhere on the image below to set a new position for the depth scale

Rotate Page

Rotate Scale

Save Position

Delete Position

Close

Polaris
Guidance Systems, LLC

Company: Demo Company
Well name: Demo Well
APIUM: 123-456
County: Harris
State: Texas
Country: United States
Field: South ranch six

Demo Well

Survey Company: Polaris Guidance Systems
Job Number: job #1
MWD Operator 1: R Gonzalez
MWD Operator 2: T Hoppeful
Location: south of 110
Rig Id: Demo Rig

TVD
5"-100'

Location			Elevation			Date		Depth
Latitude:	32		KB:	62		Start:	Jan 1, 2020	1100
Longitude:	102		DF:	62		End:	Jan 20, 2020	2406
			OL:	55				

Casing Record			Borehole Record			Other
Size	From	To	Size	From	To	
						Depth measured from: Max Temperature: Log measurements:

Click anywhere on the image to place an example depth scale image.

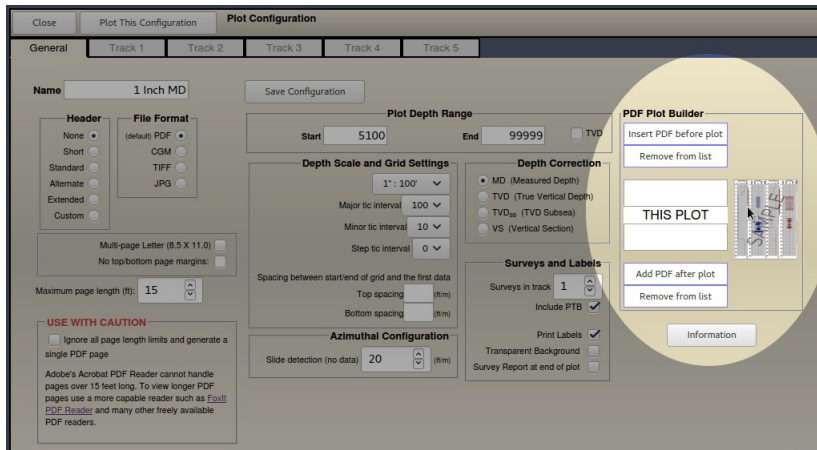
Optionally the page and/or the scale placement can be rotated.

After placing the depth scale click “**Save Position**” so that each time this file is printed the appropriate depth scale will be inserted at that position.

The position for the Depth Scale of each file is stored permanently in the database so that each time that a file by that name is uploaded it will remember it’s depth scale position. There is no need to re-define the position each time the same file is uploaded.

Plot Configurations

The last step is to setup the plot configuration to merge the new PDF header on to the plotted tracks. This feature allows multiple PDF files to be merged together. Each PDF file can be placed either before or after the plot creating a single concatenated PDF file.



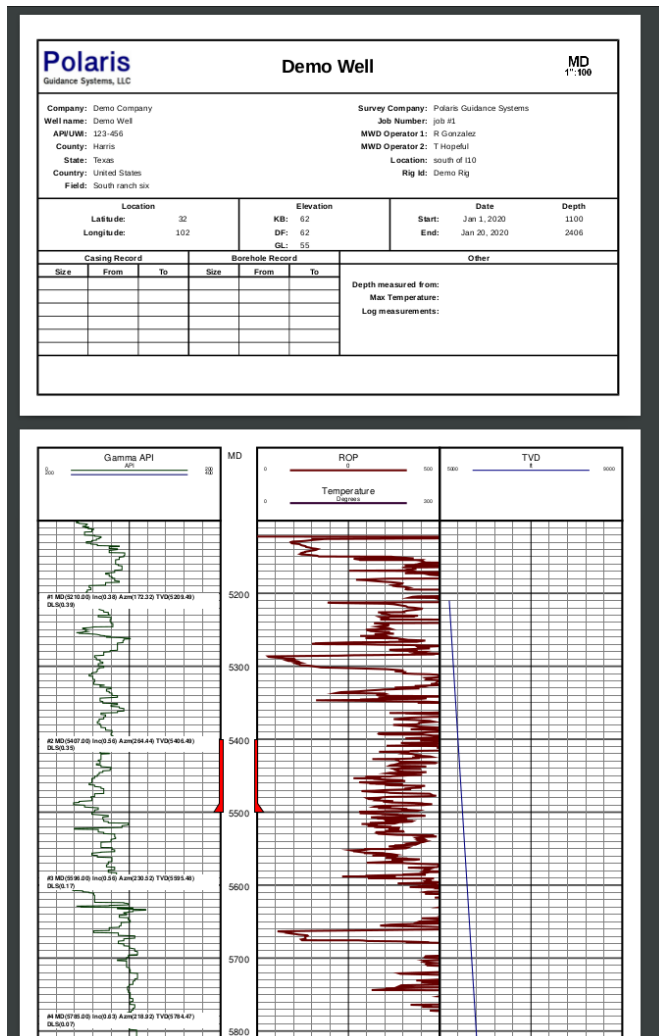
For this we will be working with the “PDF Plot Builder” section.

- Begin by making sure that the “**Header**” column on the far left is set to “**None**” to make space for the new PDF header.
- Click “**Insert PDF before plot**” button and select the PDF header file that was previously uploaded.
- Click “**Plot This Configuration**” button to view the results:



USER MANUAL

Plot Results



This example shows a custom PDF header file with the depth scale placed in the upper right side of the document. The log is then merged below this header when plotted.

Custom headers and other presentation documents can be created using any office software then converted to PDF and merged together for complete plot customization.

The example templates includes links to the database for auto-filling each well information cell.

Pay close attention to page size and create user defined paper sizes to avoid gaps between files.

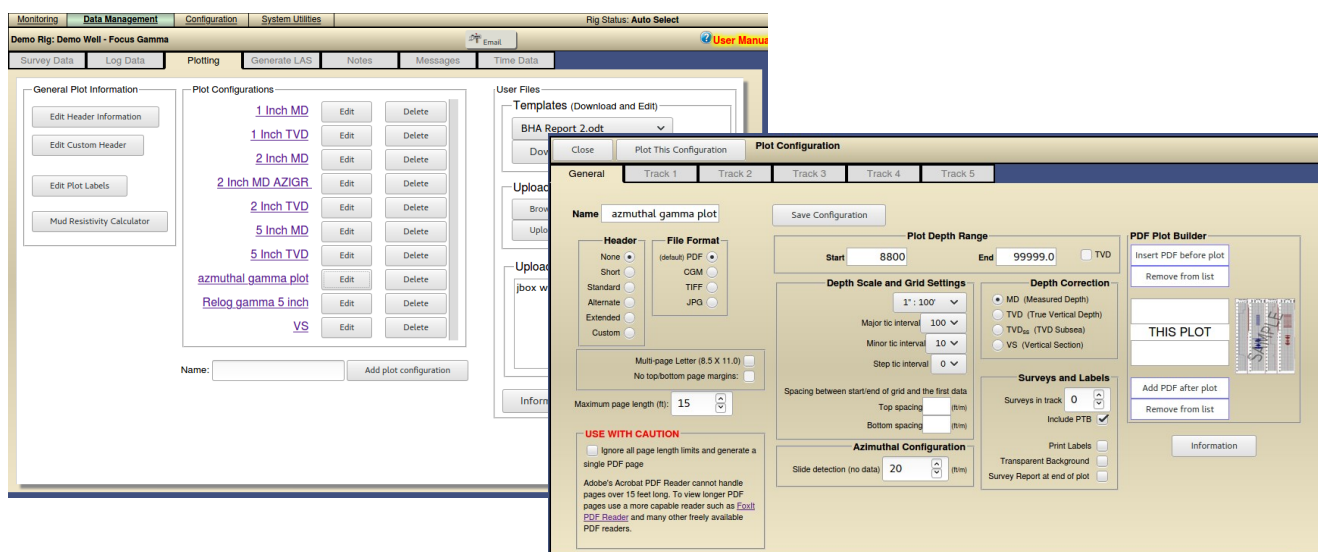
[All files are backed up and restored with the database so each header PDF file is preserved.](#)

USER MANUAL

Polaris Guidance Systems, LLC		Demo Well	
Company: Demo Company Well name: Demo Well API/UWI: County: State: Country: Field:		Survey Company: Survey Company Job Number: MWD Operator 1: MWD Operator 2: Location: Rig Id:	
Location Latitude: Longitude:	Elevation KB: DF: GL:	Date Start: End:	Depth
Casing Record		Borehole Record	
Size	From	To	To
Depth measured from: Max Temperature: Log measurements:			

Plot Configurations

Multiple plot configurations can be added providing flexibility and speed to plot generation. To add a plot configuration simply enter the name for the plot in “Create a new plot configuration” then click the “Add” button. To edit a currently configured plot click the “Edit” button next to the configuration.



General Tab

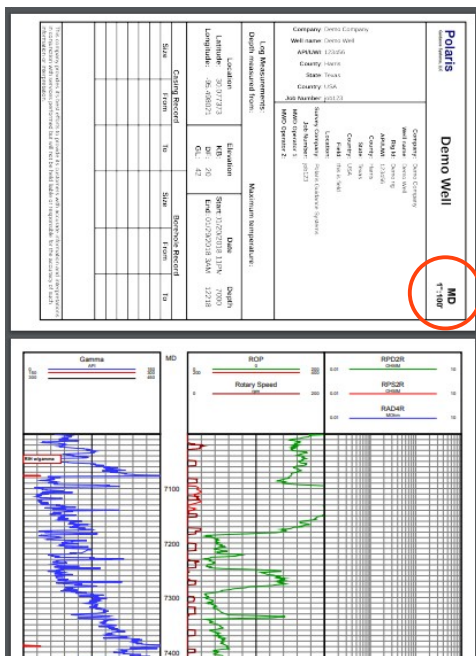
Overall information regarding the format of the plot

- **Header:** Choose the Log Header style desired/required for the logs being submitted
- **File Format:** The default file format for PDF log plots is PDF. Optionally the file format can be changed to one of 3 other image formats (cgm/tiff/jpg)
- **Multi-page output (8.5 X 11.0):** If selected the continuous-form plot will be broken up into letter sized pages
- **Measured Depth Range:** If left as default “0-99999” the software will plot from the shallowest depth available to the last depth logged. For instance if the shallowest depth is 6410 and the deepest depth is 11,208 the plot will only include this depth range.
- **TVD:** Specifies that the “**End**” depth is the true vertical depth at which to stop plotting
- **Depth Scale:** The depth scale will be determined based on the selection of Feet/Meters under Configuration>Surveys depth units selection. You will be able to select from the drop down list which scale is to be used for each Plot configuration. Scale selection changes depending on the depth units defined in the survey configuration. (feet/meters)
- **Major Tic Interval:** Draw a heavy (thick) line at every N feet/meter with a depth label
- **Minor Tic Interval:** Draw a thinner line at every N feet/meter without a depth label

- **Step Tic Interval:** If not set to zero, draw a thin line every N feet/meter without a label AND make the “Minor tic interval” a heavy (thick) line also
- **Depth Correction:** Select MD/TVD/TVDss/VS for the current plot’s depth correction
- **Surveys in Track:** The track that surveys are printed. Set to 0 (zero) for none.
- **Survey Report at End of Plot:** Appends a standard survey report to the end of the plot
- **Print Labels:** Enables/disables the printing of any labels that are defined

PDF Plot Builder

This feature allows multiple PDF files to be merged together with the log plot. Each PDF file can be placed either before or after the plot creating a single concatenated PDF file.



This example shows a custom PDF header file with the depth scale placed in the upper right side of the document. The log is then merged below this header when plotted.

Custom headers and other presentation documents can be created using any software then converted to PDF and merged together for complete plot customization.

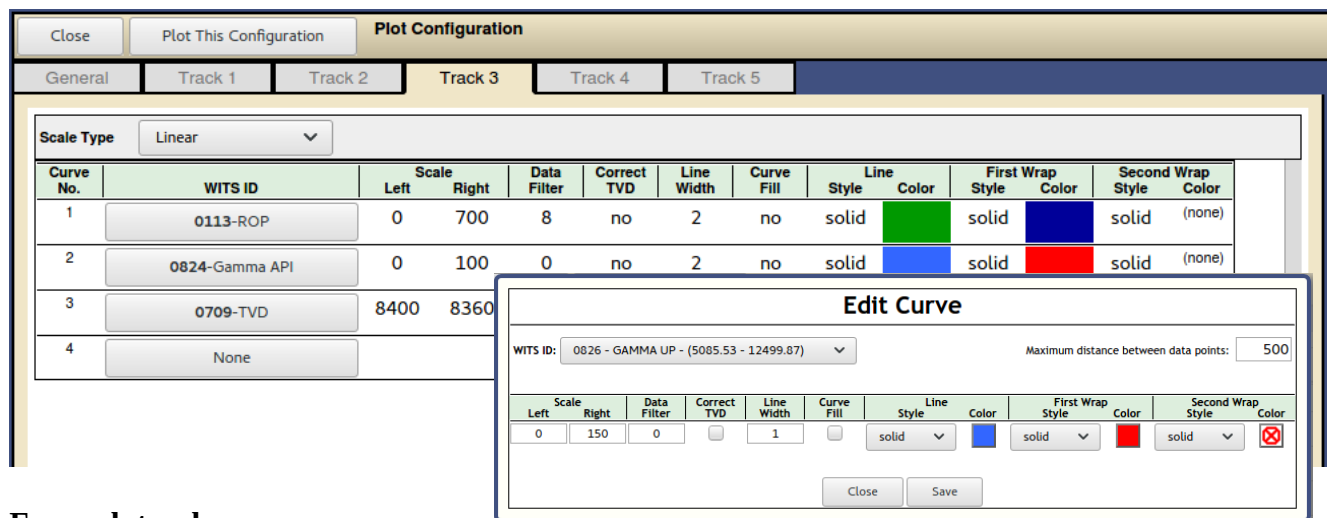
The example templates includes links to the database for auto-filling each well information cell.

Pay close attention to page size and create user defined paper sizes to avoid gaps between files.

Files stored in the Polaris database are automatically backed up and restored using the default utilities that are built-in.

Track Formatting

There can be 2-5 tracks of data and up to 16 curves per track. To disable a track simply set all curves to “None”. Also make sure that the surveys and labels (annotations) are not set to use the disabled track.



The screenshot shows the 'Plot Configuration' dialog box with 'Track 3' selected. The 'Scale Type' is set to 'Linear'. The table below shows the configuration for four curves in Track 3:

Curve No.	WITS ID	Scale Left	Scale Right	Data Filter	Correct TVD	Line Width	Curve Fill	Line Style	Line Color	First Wrap Style	First Wrap Color	Second Wrap Style	Second Wrap Color
1	0113-ROP	0	700	8	no	2	no	solid	Green	solid	Blue	solid	(none)
2	0824-Gamma API	0	100	0	no	2	no	solid	Blue	solid	Red	solid	(none)
3	0709-TVD	8400	8360										
4	None												

The 'Edit Curve' sub-dialog for Curve 2 is also shown, with the following settings:

- WITS ID: 0826 - GAMMA UP - (5085.53 - 12499.87)
- Maximum distance between data points: 500
- Scale Left: 0, Scale Right: 150
- Data Filter: 0
- Correct TVD: ☐
- Line Width: 1
- Curve Fill: ☐
- Line Style: solid
- Line Color: Blue
- First Wrap Style: solid
- First Wrap Color: Red
- Second Wrap Style: solid
- Second Wrap Color: Red

For each track:

- **Scale:** Determines the Y-axis (data values) grid scale type
 - **Linear** is typically used
 - **Logarithmic** is used for non-linear data such as resistivity
 - **Azimuthal** is used to generate images from multiple sensors that are placed around the axis of the downhole tool
- **Place density tic marks:** Places a tic mark at each depth where data for curve #1 is located

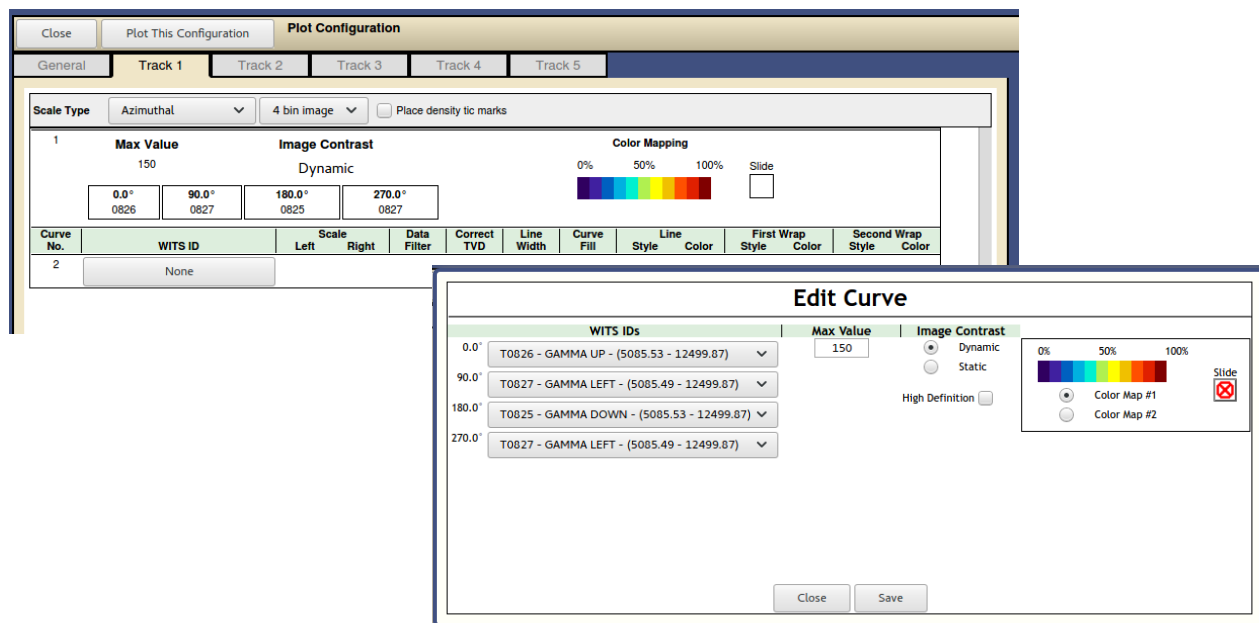
For each curve:

- **Data:** Click on the drop down box and select the WITS ID to be displayed in the track
- **Scale:** Assign the Left to Right scaling of the curve
- **Correct for TVD:** Only available for MD plots, an individual curve can be corrected for TVD then plotted along side of other MD data
- **Line Width:** The lower the number in this box the thinner the line will be. The higher the number the thicker the line will be
- **Filter:** This filter helps with “smoothing” of the curve. For gamma this value is typically set to 3.
- **Fill Curve:** Selecting this option will add shading from 0 to the main curve line.
- **Line Style:** Click the drop down box if you want to use a different style of line (Dotted/Dash/DotDash...)
- **Line/Wrap Colors:** To change the color of the main line click on the color icon and select a different color. Same for the wrap color.

When done with all changes on each Track make sure to “**Save Configuration**” before moving to the next Track or closing the Plot Configuration Editor.

Plotting Azimuthal Data

- **Max Value:** Data values are limited to this setting. Decrease for additional color contrast.
- **Image Contrast:** Azimuthal imaging can be displayed as:
 - **Static:** displays the image as absolute values within the scale range defined
 - **Dynamic:** imaging will enhance the differential between each sensor essentially increasing the contrast of the image for sharper detail
- **High Definition:** Increases the depth axis density for clarity. May take longer to plot.
- **Color Map:** Choose the desired color mapping
- **Slide:** Choose the color to use when sliding and no Azimuthal data is available

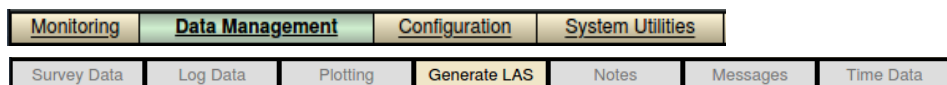


The image shows two overlapping software windows. The background window is titled "Plot Configuration" and has tabs for "General", "Track 1", "Track 2", "Track 3", "Track 4", and "Track 5". The "Track 1" tab is active. It contains settings for "Scale Type" (Azimuthal), "4 bin image", and "Place density tic marks". Below these are "Max Value" (150) and "Image Contrast" (Dynamic) settings. A "Color Mapping" section shows a color bar from 0% to 100% and a "Slide" checkbox. At the bottom is a table with columns: Curve No., WITS ID, Scale Left, Scale Right, Data Filter, Correct TVD, Line Width, Curve Fill, Line Style, Line Color, First Wrap Style, First Wrap Color, Second Wrap Style, and Second Wrap Color. The foreground window is titled "Edit Curve" and shows a list of WITS IDs with their corresponding values and coordinates. It also has "Max Value" (150) and "Image Contrast" (Dynamic) settings, along with a "Color Mapping" section showing a color bar and "Color Map #1" and "Color Map #2" options. A "Slide" checkbox is also present. At the bottom are "Close" and "Save" buttons.

Curve No.	WITS ID	Scale Left	Scale Right	Data Filter	Correct TVD	Line Width	Curve Fill	Line Style	Line Color	First Wrap Style	First Wrap Color	Second Wrap Style	Second Wrap Color
1													
2	None												

WITS IDs	Max Value	Image Contrast
0.0° T0826 - GAMMA UP - (5085.53 - 12499.87)	150	Dynamic
90.0° T0827 - GAMMA LEFT - (5085.49 - 12499.87)		Static
180.0° T0825 - GAMMA DOWN - (5085.53 - 12499.87)		High Definition
270.0° T0827 - GAMMA LEFT - (5085.49 - 12499.87)		

Generate LAS Tab



On this tab the user can define multiple configuration presets for generating LAS files. By default there is at least one LAS preset is defined (lasexport) but more can be added by simply clicking the “Add” button and entering a preset name.

Export Settings

- **Minimum and Maximum Depths:** By default enter 0 for the start depth and 99999 for the end depth. The actual LAS file will start at the first data depth and stop when it runs out of data.
- **Step Depth:** The stepping rate that the depth will be incremented by
- **Maximum Gap:** The depth range at which the LAS file will consider being a “gap” where no data has been received. Any “gaps” in the data that is less than this value will be filled in by mathematically interpolating the values at each depth.
- **Null Value:** The numeric value to use to represent a “null” or “no value”

Other Information

- **Include Projected Survey:** Includes projected surveys in the LAS file
- **Include surveys in ~Other section:** Put surveys in the ~Other section of the LAS file
- **Correct Depth Column for TVD:** Normally the depth column (column #1) is measured depth. Check this option will generate an LAS file in which the depths are corrected to TVD
- **Date/Time in first column:** Date and time will be the first column data then depth will be placed in the second column
- **Interpolate survey values between survey depths:** Rather than inserting null values between each survey depth this option will interpolate the values for each depth that lies between survey depths
- **Use Survey Formatted Output:** Use this checkbox to generate an LAS with only the depths at which each survey was stored

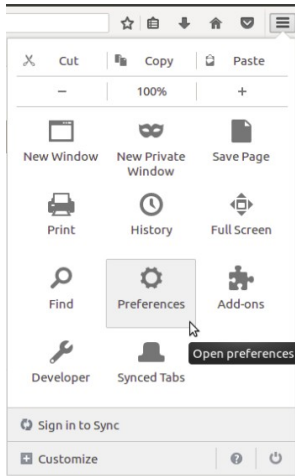
Data Column Selections

Use the pull-down menu button to select an WITS ID to include in the LAS file. Use the “Up” and “Down” buttons to arrange the ordering.

Other Applications

Firefox Configuration

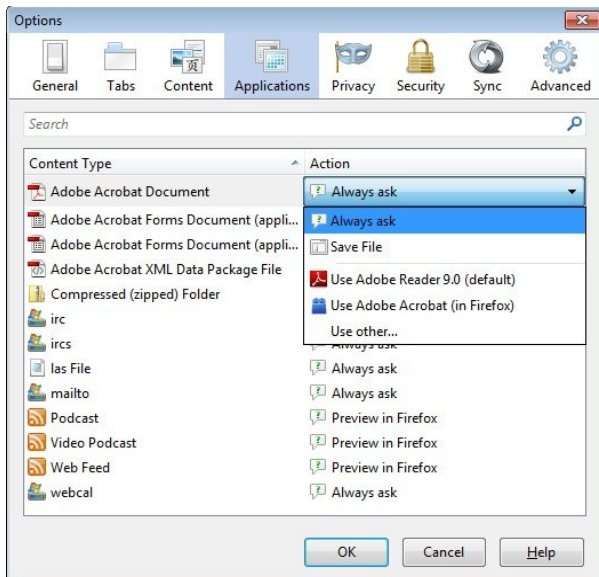
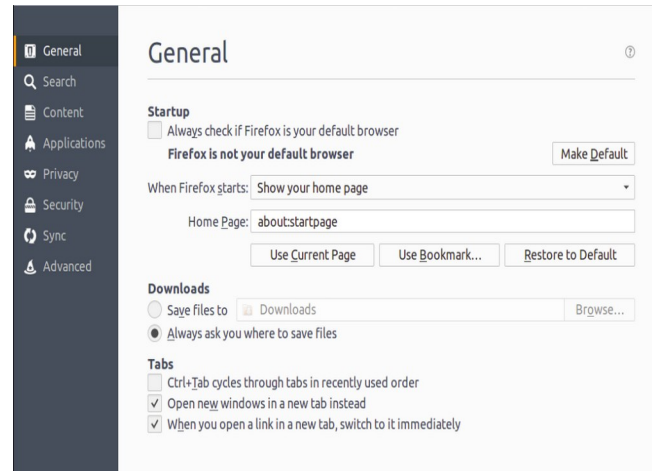
Click the **Menu** icon button in the upper-right hand corner of the Firefox window to open the menu list



Then click **Options or Preference**

Click the **General** icon above

Select “**Always ask me where to save files**”



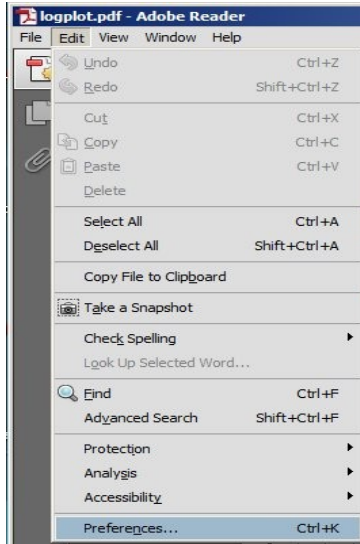
Click the **Applications** icon

Scroll down to **Adobe Acrobat Document**

Click the right-column and select “**Always ask**” from the list

Click **OK** when done

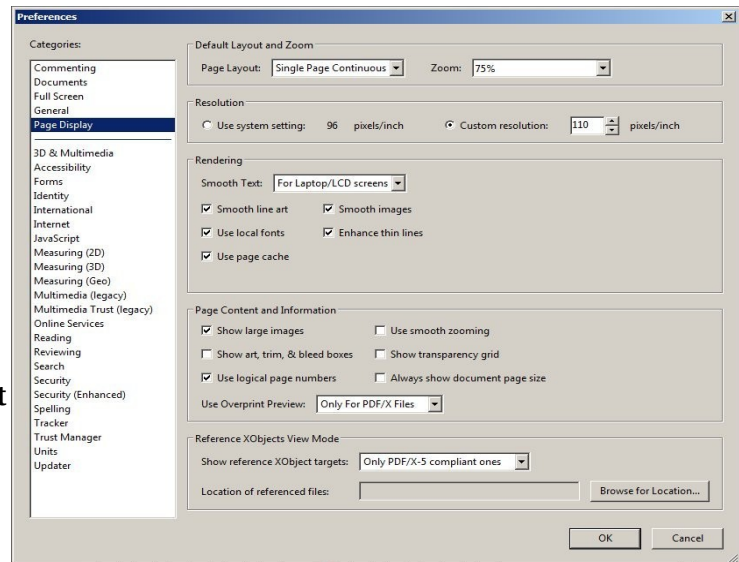
Adobe Acrobat PDF Reader Configuration



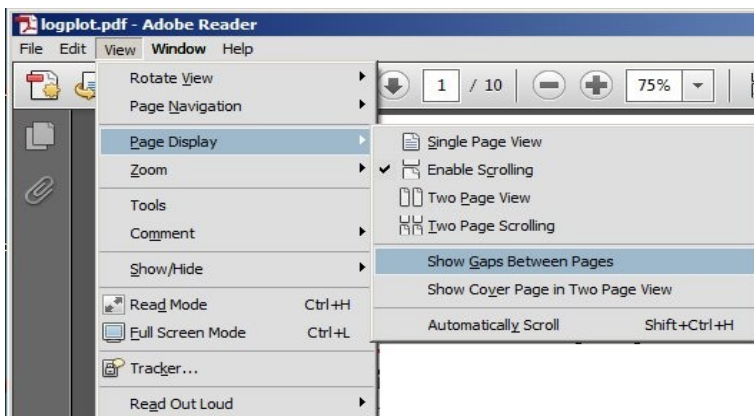
The default configuration of Adobe's Acrobat PDF Reader is not ideal for viewing the PDF log plot pages that are generated by the Polaris software. Follow these instructions on setting up Acrobat to view PDF log plot pages in a symmetrical continuous layout.

Open the Preferences dialog in Acrobat then set the **Page Display** properties **Page Layout** and **Zoom** as shown below

Click **OK** to exit



Open the menu item **View** then **Page Display**. UN-check the **Show Gaps Between Pages** so that the log appears continuous.



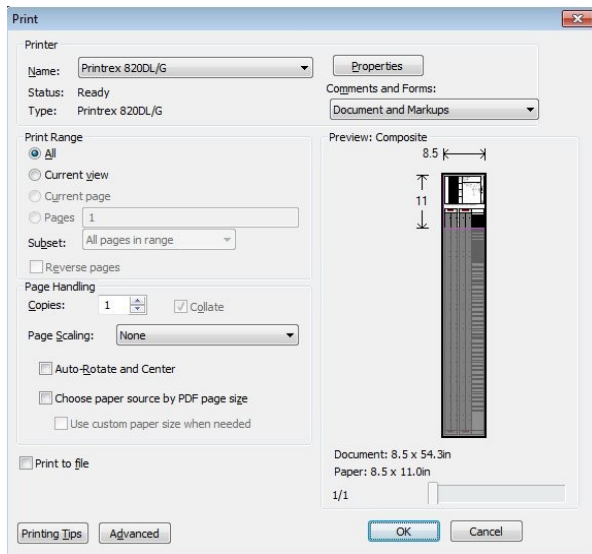
NOTE: After configuring Acrobat Reader you will need to exit the program then re-open the PDF file for the changes to take effect.

Plot a PDF Log on a Printex Plotter using Adobe's Acrobat

Printer Settings

In order to plot a PDF log file to the Printrex 820DL you will need to configure the printer before it will plot properly.

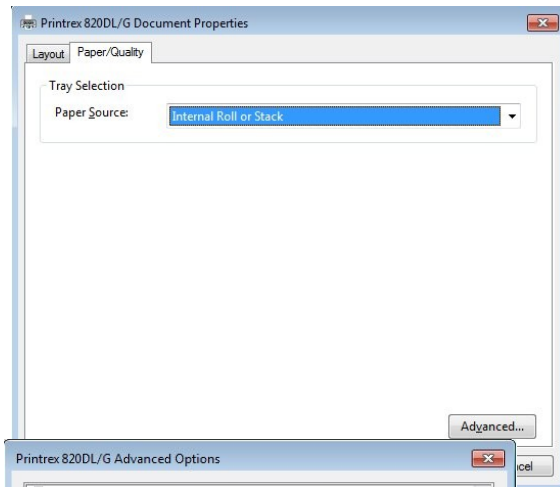
In the Printer Settings dialog ensure that ***“Auto-Rotate and Center”*** and ***“Choose paper source by PDF paper size”*** is **NOT CHECKED**.



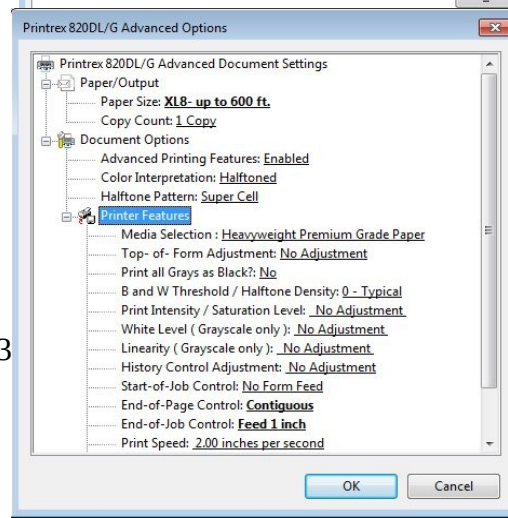
Then press the ***“Properties”*** button next to the printer name to configure the additional printer settings.

In the Printrex properties dialog ensure that the ***“Paper Source”*** is set to ***“Internal Roll or Stack”***

Then press the ***“Advanced”*** button to change the paper handling.



In the advanced dialog change the ***“Paper Size”*** to ***“XL2-up to 600 ft.”***

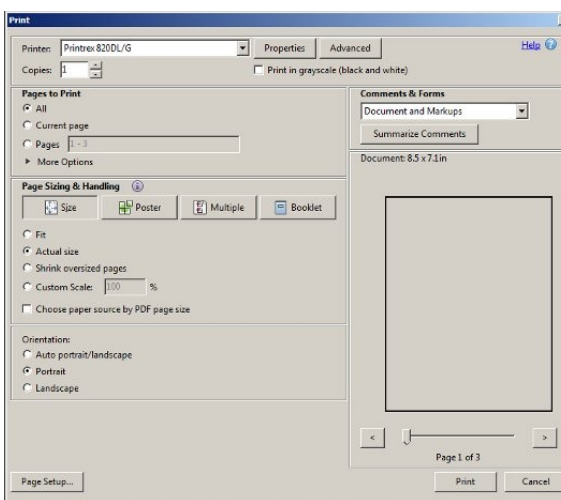


Change the “**End-of-Page Control**” to “**Contiguous**”

Change the “**End-of-Job Control**” to “**Feed 1 inch**”

Adobe Acrobat XI Replacement Printer Dialog

As of version 11 Adobe has decided to replace the standard Microsoft Printer Dialog with it's own creation. Please refer to the image for the proper setting with this new dialog.



FoxIt PDF Reader

As an alternative to Adobe Acrobat XI we also recommend the freely available FoxIt PDF Reader available at <http://www.foxitsoftware.com> Removing Adobe Acrobat XI will allow the use of the **standard** Windows printer dialog.

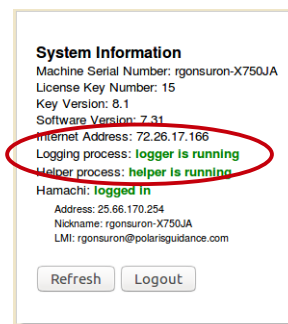
Troubleshooting

Symptom: Rig WITS data is not showing up in the monitoring screen(s)

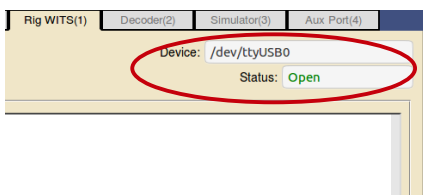
Check:

- Ensure that a null modem cable is connected between the rig WITS computer and the Rig WITS connector (port 1) on the serial port box

- Check if the background processes are running
 - Click on “**System Utilities**” at the top of the page then select the “**System Info**” tab
 - If both processes are not running as shown on right then reboot
 - Also check the “System Log” information for any mention of “illegal character received” or “hangup signal received”. If so then:
 - The null-modem serial cable is probably faulty
 - The rig monitoring equipment is transmitting garbage data



- Check if the serial port is opened
 - Click on “**Monitoring**” then select the “**Rig WITS(1)**” tab
 - If the serial port is not opened as shown on right then change both the USB cable and the serial port box



-
- Perform self-test diagnostics as described in the section “**Loopback Testing**”
- Change the null modem cable
- Check with the rig monitoring company to verify that data is being sent out

NOTE: *If none of the above resolves the problem then change out everything until it does start working including:*

- **Polaris computer**
- **USB cable to serial port box**
- **Serial port box**
- **Null-modem cable between the serial port box and the rig monitoring computer**

If you get to this point and it is still not showing any data then obviously the problem exists on the rig monitoring company’s equipment. Contact the vendor and advise them of your diagnostic results

Appendix

WITS ID's Recognized from MWD Decoder

The program will attempt to identify incoming serial port data using the table below. For directional information such as inclination, azimuth and dip angle, these are the IDs that will be used to find and auto-fill the survey form. For all other data, this is only for the serial port monitor to provide a convenient description. These descriptions are over-ridden by the configuration for each WITS ID defined by the user.

WITS ID	Parameter	WITS ID	Parameter
0010	Pumps Up Time	0731	Total gravity field (Toltech)
0108	Bit depth	0732	Total magnetic field (Toltech)
0110	Hole depth	0733	Temperature (Toltech)
0112	Block position	0734	Battery voltage (Toltech)
0113	ROP	0735	Z axis peak vibration (GV4)
0117	WOB	0736	XY axis peak vibration (GV5)
0119	Rotary torque	0737	Z axis average vibration (GV6)
0120	Rotary speed	0738	XY axis average vibration (GV7)
0121	Pump pressure	0815	Resistivity 1
0122	Casing pressure	0816	Resistivity 1 (corrected)
0128	Flow out	0819	Resistivity 2
0130	Flow in	0820	Resistivity 2 (corrected)
0140	Total gas average	0824	Gamma (corrected)
0141	(Spare) - RSSI (Sharewell)	0823	Gamma (raw)
0142	(Spare) – Total gravity field (Sharewell)	0824	Gamma (corrected)
0143	(Spare) – Total magnetic field (Sharewell)	0835	Temperature
0144	(Spare) – Gap Impedance (Sharewell)	0836	Temperature
0145	(Spare) – Dip angle (Sharewell)	0921	Battery voltage (Keydrill)
0146	(Spare) - Vibration (Sharewell)	6410	Average confidence factor
0713	Inclination	6411	Average signal amplitude
0714	Azimuth	6412	Pumps Down Timer
0715	Azimuth	6413	Pumps Up Timer
0716	Magnetic tool face	6415	Waveform data (see below)
0717	Gravity tool face	6425	Decoder pressure
0718	Survey North/-South (NS)	8908	Temperature (Extreme)
0719	Survey East/-West (EW)	8916	Magnetic toolface (Extreme)
0720	Survey Dogleg Severity (DLS)	8917	Gravity toolface (Extreme)
0723	Survey Section (VS)	9014	Dip angle (Extreme)
0725	Total magnetic field	9015	Toolface mode (Extreme)
0726	Total gravity field	9016	Total magnetic field (Extreme)
0728	Dip angle	9017	Total gravity field (Extreme)
0730	Dip angle (TolTech)		

NOTE: 6415 (waveform data) is a comma-separated list of values that represent the waveform display shape. A typical report would appear as:

641512.5,10,6,3,7,0,5,2,12,8,14,0,18.2

Each report is received at regular intervals usually 1 per second. The number of CSV values is variable and each report is concatenated to the previous set of data to form a longer waveform shape. The scaling of the values are arbitrary and the plot scale will auto-adjust to peak value of the data sets accumulated.